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MOORE'S
BRITISH
FERNS

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A HANDBOOK
OF
BRITISH FERNS:
INTENDED AS
A GUIDE AND COMPANION
IN
FERN CULTURE,
AND COMPRISING
SCIENTIFIC AND POPULAR DESCRIPTIONS,
WITH ENGRAVINGS
OF ALL THE SPECIES INDIGENOUS TO BRITAIN,
WITH REMARKS ON THEIR HISTORY AND
CULTIVATION.

By THOMAS MOORE,

MEMBER OF THE BOTANICAL SOCIETY OF LONDON; CURATOR OF
THE BOTANIC GARDEN OF THE SOCIETY OF APOTHECARIES;
AND AUTHOR OF "THEORY AND PRACTICE APPLIED TO
THE CULTIVATION OF THE CUCUMBER IN THE
WINTER SEASON."

LONDON:
R. GROOMBRIDGE AND SONS, PATERNOSTER ROW;
AND W. PAMPLIN, FRITH STREET, SOHO.

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P R E F A C E.

THE substance of what is contained in the following pages has already appeared in detached portions in a periodical publication.* In their present form, the original papers, which were not intended for separate publication, have undergone revision, and wood engravings of all the species and the principal varieties treated of, have been added. It is confidently hoped that the little manual which has thus sprung into existence may be a means—humble though it be—of promoting the growing taste which has arisen for the study and cultivation of ferns, especially of our wild ferns.

The object has been to produce a suitable pocket companion for the learner in this department of natural history ; and therefore it has been attempted to facilitate the discrimination of the genera and species, by means of analytical tables. These, together with the

* The GARDENERS AND FARMERS' JOURNAL; a weekly newspaper, the profits from which are to be devoted to the relief of aged and indigent Gardeners, and Farm Bailiffs, their widows and orphans.

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more ample descriptions and woodcuts, which are well engraved by Mr. T. Gilks, will render the determination of the different species an easy and pleasing task.

Those who are desirous of a more complete history of these plants, cannot do better than consult Mr. Newman's beautifully illustrated work, frequently referred to in the following pages.

The author takes this opportunity of thanking those who have kindly assisted him by the communication of specimens, together with the results of their experience. Such communications will at all times be most welcome.

Chelsea, September 1, 1848.

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p. 42, 2 lines from bottom, for "Aspidiums," read "of the same."

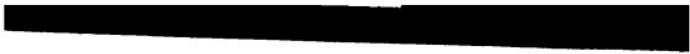
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INTRODUCTORY REMARKS.

"Ferns constitute so beautiful a portion of the creation—whether they ornament our ruins with their light and graceful foliage, wave their bright tresses from our weather-beaten rocks, or clothe with evergreen verdure our forests and our hedgerows—that it seems next to impossible to behold them without experiencing emotions of pleasure."—*Newman*.

It is not only when located among ruins, on the mountains, or in the forests, that ferns may fairly be said to constitute a beautiful, if not indeed the most lovely, portion of vegetable creation. It is true that there chiefly will the pure botanist look upon them with satisfaction, not only for the pleasure which, in the feelings of such persons, is inseparably connected with the search for them, in Nature's own demesne, but also because when reared in an artificial state, ferns, no less than other plants, have a tendency to masquerade; and these masqueradings are generally made at the expense of some portion of their botanical propriety. For these and other reasons, the pure botanist will most favourably regard that race of ferns which cling to their natural localities, themselves existing, and their race perpetuating, uninfluenced by the assistance of man. But there is another class of observers of nature, far more numerous than these, who, while their admiration of ferns in their wild, uncultivated haunts is scarcely less intense, desire also to render them subservient to their own domestic gratification. Strongly impressed with the peculiarities and the elegancies they exhibit, when covering the rugged rock or the tortuous tree-trunk, or skirting



the hedgerows with a fringe of delicate vegetation, in far off and widely separated scenes, they desire to have their own homes similarly ornamented. And this gives rise to the various phases of fern culture. Some endeavour to imitate the scenes and circumstances where and under which nature cultivates her ferns with so much success; and this effort, more or less successful as a work of taste and art, at the least ministers gratification to those who make it. Some there are, on the other hand, who imbibe a fancy for cultivating ferns in pots, and a very elegant and interesting assemblage they constitute when so treated; and this, moreover, is just the condition under which the bulk of fern admirers find fern culture convenient to their circumstances.

The cultivation of ferns is a growing fancy, and one which deserves to be fostered and encouraged. For whoever admires ferns must be a lover of nature. Their simple, and ungaudy elegance—superlative though it be—has nothing in it to attract those whose eyes can feast only on the pageantry of floriculture. A man may admire and esteem a flower for some characteristic which excludes nature altogether from any share of that esteem. But nature and ferns are, as it were, inseparable; and there is therefore no group of vegetation, the culture of which is so peculiarly adapted as this, to

“Lead through Nature up to Nature’s God.”

STRUCTURE.

Ferns may be defined as a group of acrogenous* plants, furnished with a caudex, from which issue leaf-like fronds, bearing the reproductive organs either at their back or on their edge. These reproductive organs consist of spore cases, which are usually surrounded by an elastic ring, and contain the spores or germinating atoms analogous to the seeds of other plants. The veins of the fronds are the receptacles.

Externally, ferns may be regarded as consisting of four parts, namely, the root, the caudex, the frond, and the fructification.

The Root.—The true roots consist of fibres, which in some cases are produced at intervals along the creeping caudex, and in other cases, where the caudex does not possess this creeping character, they form more or less dense tufts, pushing themselves out on all sides from among the bases of the decayed fronds, which in fact constitute the caudex. They are more or less wiry in their texture, sometimes simple and sometimes branched, and in many cases, especially on the younger portions, are clothed with fine hairs or scales. These organs constitute, of course, the principal feeding apparatus of the plants.

The Caudex. — The caudex, sometimes called the rhizome or rootstock, is often erroneously regarded as the root. It is, however a modified stem, and assumes, in the case of ferns, two very distinct appearances, some-

* Asexual or flowerless plants, in which the stems and leaves are distinguishable.

times lengthened and creeping, either beneath or upon the surface of the earth, and sometimes short and tufted, forming little more than a crown, whence the fronds issue. This latter form does, however, sometimes in age, become considerably elongated, and then affords an imperfect idea of the trunks of the tree ferns of the tropics, which, in some cases, attain forty or more feet in height. Of our native species, this tendency most decidedly exists in the *Osmunda regalis*, whose caudex may occasionally be met with from one to two feet high. When the habit of the caudex is creeping, it usually assumes a tortuous, branching form, and extends itself a few inches below the surface of the earth, becoming, in fact, a branching under-ground stem, from which the fronds spring up individually and distinct, and more or less widely separated. Sometimes the caudex of the stronger growing species extends to a considerable distance as well as depth. That of *Polypodium vulgare* spreads widely in a lateral direction; and Newman mentions having met with the under-ground stems of the *Pteris aquilina*, extending in some cases to a perpendicular depth of fifteen feet. The creeping caudex greatly facilitates the propagation of those species which possess it; a portion of moderate length, bearing a frond, if separated from the rest, and placed under proper conditions, will soon establish itself, and become an independent plant.

The Frond.—The frond is the most conspicuous portion of ferns, and that for the sake of which the plants are cultivated. Issuing from the caudex, which is a true stem, they are, in some measure, analogous to the leaves of other plants; and, in consequence, the term *frond* has, by some, been objected to as unnecessary, and that of *leaf* employed in its stead. The peculiar manner, however, in which the fructification is borne on this part of the plant, seems to render it desirable to maintain the distinctive name of *frond*, which also is very generally adopted—a still further reason for its continuance. An analogy has been traced between the fronds and the deciduous branches of other plants.

In their undeveloped state, the fronds of the greater number of the species of ferns, are coiled up inwards towards the axis of development, forming a series of convoluted curves. The folding up of the fronds of ferns, as of the leaves of other plants, is termed their *vernation*; and the peculiar form of vernation which is most general among ferns, and in which the undeveloped parts are rolled inwards or bent like the head of a crozier, is said to be circinate. The only British species which differ from this, in the mode of their vernation, are the Botrychium and the Ophioglossum, and in these the young parts, instead of being rolled up, are folded straight. As the fronds become developed, these parts gradually unfold, the more compound of the circinate species being in most cases seen to have the divisions of the frond also rolled up in a similar manner; in this case, the larger divisions first open, and afterwards, in order, the pinnæ, pinnules, and lobes. In many species, the partially developed fronds have a very graceful appearance.

When the fronds become fully developed two parts appear distinguishable. At the base, more or less extending upwards, is a leafless portion, which is called the *stipes* or stalk, by some, and the stem, by others: the latter term, however, more properly belongs to the caudex, and is, therefore, objectionable, as applied to any part of the frond. Upon the lower part of the stipes, generally, and sometimes even throughout the entire length of the rachis, is found, more or less densely situated, a covering of paleaceous or membranous scales; in some cases this is confined to a few small scattered scales, near the base of the stipes, but in the other cases they are so large and numerous as to produce quite a shaggy character. They are most generally regarded as portions of disrupted epidermis, occasioned by the pressure of the sap beneath. Whatever their origin, they are to be regarded as special organs, being very constant in their appearance and development in the same species. The upper portion of

the frond, extending more or less downwards, is leafy, and through this leafy portion, the substance of the stipes is continued onwards to the apex of the frond, being, however, distinguished in this upper portion by the term *rachis*.

The leafy portion of the frond offers many states of division, the parts being much influenced in size and number by external circumstances. Sometimes it is simple or undivided; sometimes pinnatifid, or more or less deeply cleft; sometimes pinnate, or divided into distinct leaf-like-divisions, or *pinnæ*; sometimes bipinnate, when the *pinnæ* are themselves pinnate (occasionally the *pinnæ* are only pinnatifid, or deeply cleft) this second series of *pinnæ* being called *pinnules*; sometimes the fronds are still more compoundedly divided, the *pinnules* being either pinnatifid, or again pinnate. The character of the division of the frond is much employed in distinguishing the species. The outline of the fronds varies greatly, being distinguished by the terms which are applied to the same forms in other plants; the most common forms of the outline are, the lance-shaped, triangular, and oval. In their magnitude, the fronds vary from two or three inches to five or six feet in length, and from less than an inch to two feet or more in width; this applies only to British species.

The Fructification.—It has been already stated that the reproductive organs of ferns consist of *spores*, or germinating atoms, enclosed in the *spore-cases*, also sometimes called *thecæ*, and sometimes *capsules*; the latter term is objected to, on the ground of that kind of pericarp being essentially connected with the power of conveying fertilisation from the staminal apparatus to the ovules implying the existence of a certain definite relation between the various parts it contains, nothing of which is found in the spore-cases of ferns. These spore-cases are either furnished with a short pedicel, which is extended around them in the form of a ligamentous ring (*annulus*), the elasticity of which causes their irregular

dehiscence ; or they are sessile, and without the ring, and regularly valved. Hence the ferns are sometimes divided into the groups *annulatae* and *exannulatae*. Of the annulate ferns, when the fructification is borne on the under surface, or the back of the frond, as it is called, it is said to be *dorsal*; such ferns are called *dorsiferous*; but when it is protruded from the edge of the frond, it is said to be *marginal*. Dorsiferous ferns—native as well as exotic—are by far the most numerous; and in these the spore-cases are collected together into groups of various forms, which are called *sori*; they are sometimes placed in distinct spots, and sometimes their arrangement is linear or oblong. In the Hymenophyllous group, in which the fructification is marginal, the spore-cases are collected around the free extremities of the veins. The remaining genera of British ferns are exannulate, and have their spore-cases collected upon the sides or surface of the contracted fronds. Again, the spore-cases either spring from the actual surface of the fronds, or from beneath the cuticle, which, in this case, is pushed up in the form of an investing membrane, called the *indusium* (or by some *involucrum*) : hence certain groups of the dorsiferous ferns are sometimes distinguished as being *indusiate*, or *non-indusiate*. The term *involucrum* seems more appropriately applied in the case of such ferns as the Woodsias, where the spore-cases have no covering, but a capillary divided membrane placed beneath them, that is, between them and the frond.

Ferns are the most highly developed, in their internal structure, of all the acrogenous plants. In the lower orders of this group of vegetation, the whole plant consists merely of cellular tissue ; but in the more highly developed orders, of which ferns hold the highest rank, both vessels and woody matter are found. The woody matter of ferns, which occurs in the caudex, consists almost exclusively of large scalariform or dotted ducts, embedded in hard plates of thick-sided, elongated tissue, which usually assumes an interrupted sinuous appear-

STRUCTURE.

ance, but occasionally, according to Brown, forms a complete tube. The fronds also, are furnished with annular ducts, in the vascular tissue with which their stipes and rachis are furnished. The leafy portion of the frond is traversed by simple, dichotomous, or netted veins, of equal thickness, which are composed of elongated cellular tissue, with occasional ducts. Stomates are frequently met with in the cuticle.

The spore-cases arise from the veins, either on the under surface of the fronds or from their margin; or sometimes they appear to be formed of the contracted substance of the frond. The spore-case seems to have been for a long time considered as a special organ, not having a very clear analogy with any organ occurring in flowering plants. Dr. Lindley has, however, offered the following theory of its nature:—The thecae may be considered as minute leaves, having the same gyrate mode of development as the ordinary leaves or fronds of the tribe; their stalk being the petiole, the annulus the midrib, and the theca itself the lamina, the edges of which are united. This opinion of their nature originated from a persuasion that there was no special organ in ferns to perform a function which in flowering plants is executed by modifications of leaves. The theory, however, applies only to the gyrate ferns. In the case of those which are furnished with what is called a broad transverse ring, it may be considered, either, that the midrib of the young scale, out of which the case is supposed to be formed, is not so much developed; or the case may be considered as a nucleus of cellular tissue, separating both from that which surrounds it and also from its internal substance, which latter assumes the form of sporules, in the same way as the internal tissue of an anther separates from the valves under the form of pollen. In *Ophioglossum*, there is no spore-case beyond the involute contracted segments of the spore-bearing leaf. (*Lindl. Veg. Kingd.*) The gyrate spore-cases of dorsiferous ferns, when mature, split suddenly with a

transverse fissure, thus ejecting the spores ; those which are furnished with a horizontal ring, on the other hand, burst vertically ; the others are regularly two-valved.

The spores are minute, roundish bodies, arranged without order within their cases. The spores differ from seeds, in having no cotyledons, consisting merely of a mass of cellular tissue. In true seeds, the radicle or root, and the plumule or shoot, are developed from determinate points ; but in the spores of ferns, as of other acotyledons, it is not so. They grow indifferently from any part of their surface, producing, as the first indication of their germination, an irregular, unilateral scale, which is to be regarded as a primordial leaf : in this state young ferns look like a species of Liverwort. This scale expands more or less, according to the habit of the species, and by degrees becomes thicker, both above and below, at one point ; the upper part, acted on by light and air, gradually assumes the form of an upright frond ; and the lower side, more immediately influenced by moisture from contact with the soil, protrudes the root. The young fronds are at first very different from the more matured state of the species, being in all cases much less divided : as they grow, however, they assume more and more the character peculiar to them ; but they are generally two or three years in arriving at a mature state.

Arguing on the ground that the reproductive bodies of ferns are produced by impregnated fertile flowers, Sir J. E. Smith has objected strongly to the application to them of the term, spores ; and this he calls not merely a dispute of words ; for if, he says, the bodies in question are not really seeds, the offspring of impregnation, they are gemmæ, buds, or offsets. The existence of sexual organs in these plants, has been strongly maintained by other persons. On the other hand, it has, with more apparent reason, been denied that their existence is proved. Stigmas have never been detected, but various bodies have been supposed to be anthers or analogous to anthers : even the glands which occur on the surface of

the plants have been so regarded. Certain thread-like bodies, which spring up among the spore-cases, and which are filled with a grumous matter, sometimes exuded in the form of a crust, are now most commonly regarded as the anthers, by those who regard the sexual organs as present; but the opinion is by no means universally entertained. Some probability seems to have been given to the presence of anthers by what has been considered as an occurrence of mule ferns; but good evidence is wanting to show that such instances are connected with hybrid action.

CLASSIFICATION AND DISTRIBUTION.

Formerly the characters by which ferns were divided into the groups called genera, were derived from the shape of the frond. As, however, the knowledge of species became extended, this principle of division was found to be vague and unnatural in the extreme. Subsequently the shape of the sori, or clusters of spore-cases, was resorted to for the purpose of generic definition; but this, though an improvement on the former, was still insufficient. The form and attachment of the indusium was next made a leading principle of arrangement, by Sir J. E. Smith; and this, which was found to define much more natural genera, has been much followed, and is not indeed wholly discontinued now. A mode of arrangement, now held in high favour, is derived from the character of the venation of the frond, and the connection of the veins with the sori. From the nature of the venation and the character of the indusium, taken together, very complete and satisfactory generic definitions may be drawn; and other tangible characters, serving to connect the genera into groups, are obtained from the spore-cases and the mode of vernation.

From the presence or absence of the elastic ring, which has been already described, all the British species may be readily divided into two groups to which the terms *annulatae* and *exannulatae* are applied. The further subdivision of these groups into sub-classes and genera, is exemplified in the following analytical table:—

Analysis of Genera.

- Vascular Acrogens having dorsal or marginal one-celled Spore-cases, containing spores of one kind only.
- * Spore-cases with an articulated elastic ring, bursting irregularly I. POLYPODIACEÆ.
 - † Ring vertical. Fructification dorsal (*Polyopodiae*).
 || Spore-cases arranged in distinct clusters (sori).

Sori without an indusium

Sori circular, margin of frond flat 1. *Polyodium*.
Sori circular, at length confluent, concealed by the reflexed margin of the frond 2. *Allosorus*.

Sori circular, with inferior capillary-divided involucrum 3. *Woodia*.

Sori with an indusium.
Indusium formed of the separated cuticle.

Sori springing from back of lateral veins.

Indusium reniform, attached by its sinus 4. *Lastrea*.

Indusium circular, attached by its centre⁵. *Polystichum*.
Indusium hooded or cucullate, attached by its base 6. *Cystopteris*.

Sori springing from side of lateral veins.
Sori oblong-reniform, indusium opening towards midvein, free margin fringed 7. *Athyrium*.

Sori elongate, straight, indusium opening towards midvein 8. *Asplenium*.

Sori elongate, scattered, indusium narrow erect on back of vein, and (except the lowest) opening towards mid-vein, back of frond densely scaly	9. <i>Ceterach</i> .
Sori elongate, straight, in pairs, indusium opening on the inner side, or along the centre of the twin sorus	10. <i>Scolopendrium</i> .
Indusium formed of the reflexed margin of frond	11. <i>Adiantum</i> .
Spore-cases arranged continuously.	
In lines parallel to midrib	12. <i>Blechnum</i> .
In a marginal line	13. <i>Pteris</i> .
Ring horizontal or oblique. Fructification marginal (<i>Hymenophyllum</i>).	
Involure of same texture as frond.	
Receptacle surrounded by elongated cup-shaped involucre, exserted	14. <i>Trichomanes</i> .
Receptacle surrounded by 2-valved involucre, included	15. <i>Hymenophyllum</i> .
* Spore-cases, without an articulated elastic ring, 2-valved.	
† Vernation circinate, rachis woody	
Spore-cases, reticulated or striated, stalked	
† Vernation straight, rachis succulent	
Spore-cases, not reticulate or striated, sessile.	
Spore-cases in compound spikes, distinct	17. <i>Botrychium</i> .
Spore-cases in simple spikes, connate	18. <i>Ophioglossum</i> .

The ferns are widely distributed throughout Britain, occurring more or less abundantly from north to south and from east to west, except where local peculiarities are unfavourable to their existence : on the summits of our loftier mountains they occur but rarely, but here their comparative absence is to be attributed not so much to the actual elevation of these tracts, as to the bleakness of the situation, which condition is generally unfavourable to ferns. They are found, however, existing under a variety of circumstances ; and though undoubtedly a calm and moist atmosphere is, in a general sense, most favourable to their development, there are but very few species which are strictly confined to localities where these conditions prevail. When growing in drier and more exposed localities, they follow the law which affects vegetation generally, being in such situations smaller, more rigid in texture, and often less divided. It is an interesting inquiry how far the closely allied series of species which in some few instances are met with among our native ferns, may have acquired their differences of aspect from the influence of circumstances such as these ; the characters thus induced having now become to a certain extent fixed, so as to present, what can hardly be refused acceptance as, real specific distinctions. I must confess that my own opinion inclines to this view of the matter ; and I may adduce the authority of the late learned Dr. Herbert, to support the principle which this view involves. In a very clever paper on vegetable hybridisation and the distinction of species, published in the *Journal of the Horticultural Society* (1847), Dr. Herbert broadly acknowledges his acquiescence in the principle of variations amongst plants, partially, if not entirely, induced by the various circumstances under which they may have been placed, these variations ultimately becoming fixed characters, transmissible to succeeding generations. Look, for example, at the forms of *Polystichum*, which bear the several names of *Lonchitis*, *lobatum* var. *lonchitidoides*, *lobatum*, *aculeatum*, and *angulare*. There is

here a series of closely allied forms, which apparently completely unite the two extremes, and that not only in respect to form, but also as regards their texture and habit; and yet, without the intermediate forms (and hardly perhaps with them), very few persons could be induced to look upon *P. Lonchitis* and *P. angulare* in any other light than as clearly and widely separated species. In this case, *P. Lonchitis* is an alpine species, inhabiting bleak and exposed situations in the north; and it is accordingly rigid, and its parts are but slightly developed: *P. angulare*, on the other hand, is found principally in shady and sheltered localities in the south, and some of its forms are exceedingly compound, and delicate in texture. This is perhaps the strongest illustration of these views afforded by our native species, but there are some other series of forms which exhibit a similar tendency—amply sufficient to justify the prosecution of the inquiry on the part of any one who may have the opportunity of following it up.

The proportion which the ferns bear to the phænogamous portion of the flora of the British Isles, may be taken in round numbers, as 1 to 35. In Scotland, they are computed to hold the proportion of 1 in 31. It may be interesting to quote the following passage relative to the geographical distribution of ferns, generally considered:—There is an enormous disproportion between ferns and the rest of the flora in certain tropical islands: thus, in Jamaica, they are 1-9th of the phænogamous plants; in New Guinea, D'Urville found them to bear the proportion of 28 to 122; in New Ireland, they are as 13 to 60; and in the Sandwich Isles, they are as 40 to 160. It is, moreover, clear from the collections of Wallich, that ferns must form an important feature in the vegetation of the Indian Archipelago. Upon continents, however, they are found to be far less numerous: thus, for example, in equinoctial America, Humboldt does not estimate them higher than 1-36th; and in New Holland, Brown finds them 1-37th. They decrease in proportion

towards each pole; so that in France, they stand as 1-63rd; in Portugal, as 1-116th; in the Greek Archipelago, as 1-227th; and in Egypt, as 1-971st of the flowering plants. Northwards of these countries, their proportion again augments, and they are found to form 1-31st of the phænogamous vegetation of Scotland, 1-35th in Sweden, 1-18th in Iceland, 1-10th in Greenland, and 1-7th at North Cape. The Adder's tongues (*Ophioglossaceæ*) are most abundant in the islands of tropical Asia; they occur, however, in the West Indies, and are by no means uncommon in the temperate latitudes of both worlds.—(*Veg. Kingd.*)

In their affinities, the ferns approach flowering plants through the Cycads, a group of Gymnogens, which may be considered as closely allied to them, on account of the imperfect degree in which the vascular system of that order is developed, of their pinnate leaves with a gyrate vernation, and of their naked ovules borne on the margins of contracted leaves, as the spore cases are upon the leaves of *Osmunda* and *Ophioglossum*. To Conifers, another group of Gymnogens, they also advance very closely through Salisburia, whose leaves might readily be mistaken for those of a fern. Among Acrogens, their affinity with *Equisetums* is not very obvious, consisting chiefly in the presence of annular vessels, and in the absence of flowers. The Lycopodiums, which have some relationship, are distinguished readily by their axillary spore cases, which dehisce by regular valves. The Pepperworts (*Marsileaceæ*) are, according to Lindley, much more remote.

BRITISH FERNS.

GENUS I.

POLYPODIUM.

POLYPODIUM, *Linnæus* (*Polypody*).—Mid-vein distinct, lateral veins branched free; sori circular, naked, attached at the back of the lateral veins.—Name derived from the Greek, *poly* (many), and *pous* (a foot) in allusion to the numerous foot-like divisions or branches of the creeping caudex.

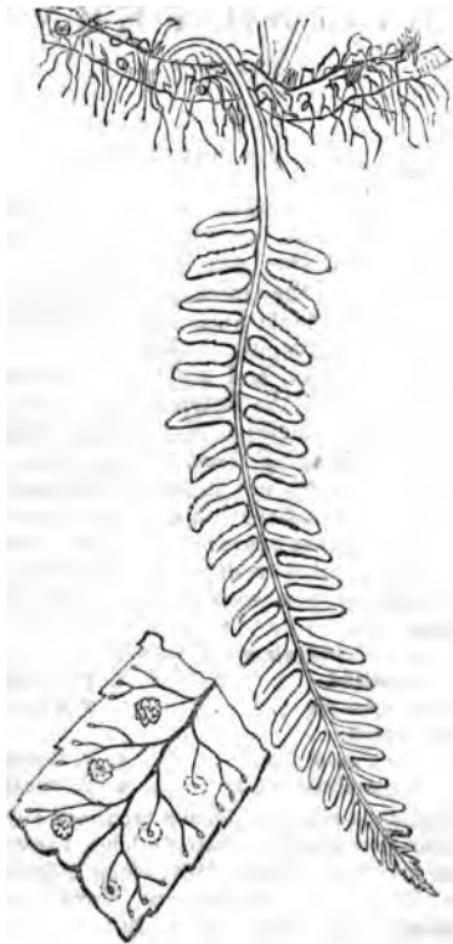
The most common and authentic illustration of this genus is seen in the *Polypodium vulgare*, which abounds in most localities, and is met with under considerable variety of form. The other species usually referred here, are placed in *Polystichum* by Roth, who is said to have found an evanescent indusium, which does not appear to have been noticed by others. I have failed to detect it. Newman places them in *Lastrea*, in a section with *Thelypteris* and *Oreopteris*.

Analysis of the Species.

Fronds pinnatifid	:	:	:	1. <i>P. vulgare</i> .
Fronds sub-pinnate	:	:	:	2. <i>P. Phegopteris</i> .
Fronds ternate.				
glabrous	.	.	.	3. <i>P. Dryopteris</i> .
glandular-mealy	.	.	.	4. <i>P. calcareum</i> .

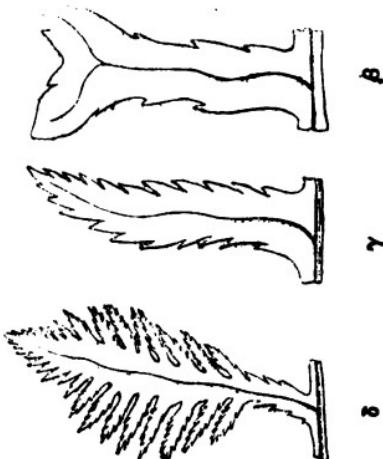
1, *Polypodium vulgare*, Linnæus (common Polypody); fronds lanceolate deeply pinnatifid; lobes linear-oblong, somewhat serrated.—DESC: *Polypodium vulgare*, Linn. Sm. Eng. Fl. iv., 267. Newm. Brit. Ferns, 2 ed., 111. Bab. Manual, 2 ed., 408. Hook. Brit. Fl., 5 ed., 437.

Franc. Anal., 3 ed., 21.—FIG : Eng. Bot., 1149. Newm.,
111. Franc., pl. 1., fig. 2.



POLYPODIUM VULGARE.

- $\beta.$ *bifidum* : lobes more or less regularly bifid at apex.
 $\gamma.$ *serratum* : lobes deeply or doubly serrated.
 $\delta.$ *cambricum* : lobes deeply and interruptedly pinnatifid.—*P. cambricum*, Linn.



P. vulgare, vars.

The Irish plant usually referred to the variety *cambricum*, is often met with having fewer lobes, and these more obtuse, than in the characteristic form of the Welsh variety; the upper part of the frond often scarcely differing from the ordinary state of the plant. Sometimes entire fronds are deeply crenated, which is the variety *sinuatum* of Willdenow : at other times the upper part of the frond only is thus crenated, while the primary lobes on the lower part are deeply lobed, after the manner of *cambricum*.

Other slight variations of this species are sometimes met with ; one of these, with more pointed lobes than ordinary, is called *acutum* ; the variety *bifidum* is sometimes more than two-lobed, and is then called *proliferum*. A tolerably perfect series may be traced from the com-

mon form, through serratum and sinuatum, up to the most compound form of cambricum.

The common Polypody is furnished with a creeping caudex, which is densely covered on the younger parts with brown taper-pointed paleaceous scales, and becomes bare in age, from the peeling off of the scaly cuticle. This caudex extends over the surface of walls, rocks, shady banks, old thatched roofs, or tree-stumps, throwing out in its progress branching, densely hairy, fibrous roots. The fronds perish in the winter, when exposed to frost, and are renewed in May and June; under shelter it becomes evergreen; they are generally erect at first, but by degrees acquire a drooping habit. The stipes is greenish, sometimes yellowish, usually nearly equalling in length the leafy portion of the frond; it is slightly grooved on the upper side. The fronds are pinnatifid, with a lanceolate outline, the lobes parallel, usually broadest at the base, and gradually shortening towards the apex of the frond; they vary from six to twelve, or eighteen inches in length; the lobes are flat oblong, nearly linear, more or less serrated, and somewhat blunt-pointed, though occasionally they are more acute; in the variety bifidum they are cleft at the end into two diverging lobes; in serratum, they are much more deeply, and often bluntly serrated, than in the usual form, and also more acute; in cambricum, the frond is much broader, though by no means always ovate, as sometimes described, and the lobes themselves are more or less deeply and irregularly jagged or cleft, becoming doubly pinnatifid. The venation is distinct; each of the lobes has a somewhat tortuous prominent mid-vein, from which, alternately, on either side, branch out the lateral veins; these lateral veins are usually described as being divided into four branches, but I only find this to be the case in vigorous fronds: in smaller and weaker fronds, though fertile, they have but three branches: in some cases, on the stronger fronds, I have occasionally observed five branches; each of the barren branches terminates near the margin of the frond, in a little club-like head; the lowest branch, which takes a direction towards the apex of the segment, reaches about midway between the margin and mid-vein, and terminates, when fertile, in a sorus, or cluster of spore-cases; when barren, in a club-like head, like the rest. The sori are circular, entirely without an indusium, and at an advanced

stage, often become crowded and confluent. All the fronds are usually fertile, the sori being confined to the upper part of each. The fructification is mature in September and October.

This is a very common species, being found abundantly growing on the stumps and trunks of trees, on old thatched roofs, against walls, and moist rocks, and on shady banks, pretty generally distributed over the United Kingdom. It is also met with in various other parts of Europe, in Asia, and in Africa.

This plant is invested with an antiquated medicinal reputation, but has now no place in the pharmacopœias. The caudex has a sweetish taste, which, however, by long boiling, becomes bitter. An infusion of the fresh caudex is said to operate as a mild laxative. The fronds—given in the form of a mucilaginous decoction—were formerly, and probably still are used in remote parts of the country, as a cure for colds and the hooping cough, in children: for this purpose the matured fruitful fronds are gathered in the autumn, and, when dried, hung up for preservation until required for use, when they are slowly boiled with coarse sugar.

The common Polypody is exceedingly well adapted for planting on artificial rockwork, and among rustic work, formed of the stumps of old trees; especially delighting to extend its creeping caudex over a decaying mossy tree-stump. It will, however, grow in almost any situation, provided there is free moisture about its roots, but is much finer and more delicate in the shade, than when exposed. When depending from the trunks and exposed roots of old trees, on deep, shady banks, under which circumstances it is often seen naturally, it must be ranked as a decidedly ornamental object. A compost of turfy peat, decayed wood, porous broken bricks, and rough charcoal, will be a proper medium for its roots, under pot culture. It is readily increased by dividing the creeping caudex.

2. *Polypodium Phegopteris*, Linnaeus (mountain Polypody or Beech fern); fronds sub-pinnate: pinnæ narrow-lanceolate, pinnatifid, with linear-oblong blunt lobes the lowest pair deflexed standing forward, the upper ones united at the base.—DESC.: *Polypodium Phegopteris*, Linn. Sm. Eng. Fl., iv., 269. Newm. Brit. Ferns, 2 ed., 115. Bab. Manual, 2 ed., p. 408. Hook. Brit. Fl.,

5 ed., 437. Franc. Anal., 3 ed., 23. *Polystichum Phegopteris*, Roth. *Lastrea Phegopteris*, Newm., p. 13.—Fig.: Eng. Bot., 2224. Newm., 122. Franc., pl. 1, fig. 3 (bad).



POLYPODIUM PHEGOPTERIS.

The mountain Polypody has a tough, dark-coloured caudex, slightly scaly, and extensively creeping, throwing out black fibrous roots. The fronds are hairy, of a delicate texture, and pale green colour; they are produced in May,

being developed with great rapidity, reaching maturity in July, and becoming destroyed by the earliest frost. The stipes is succulent, and very brittle, erect, with a few scattered light coloured scales near the base, and is much longer than the leafy portion. The fronds are pinnate, of a triangular form, tapering to an acute point, and varying considerably in size from four or five to ten or twelve inches, or more, in length. The pinnae are narrowly-lanceolate, acute, slightly curved in the direction of the apex of the frond, usually opposite, but sometimes alternate; the lowest pair is bent downwards, and placed at a marked distance from the others, their base not being adnate with the rachis, but minutely stalked: the next pair of pinnae is more or less adnate at the base; the remainder are united to the rachis by their whole width. When the pinnae are opposite, a cruciform figure is presented by these adnate basal segments; in the upper part of the frond, the decurrent bases of the pinnae are continuous along the rachis. The pinnae are deeply pinnatifid, those near the apex becoming entire; the point of the frond is, indeed, altogether rather pinnatifid than pinnate. The venation of the lobes consists of a distinct but slender mid-vein, scarcely thicker than the lateral ones, which are alternate, mostly unbranched, extending to the margin, those near the base of the segments bearing each a small sorus near their extremity; the sori, which are circular, thus become nearly marginal. The fructification reaches maturity in July.

This species, though somewhat limited in its distribution, is common in some localities, occurring in moist mountainous situations, in damp woods, and in the vicinity of waterfalls. It seems to be constantly found in damp situations. It occurs in the southern, western, and northern districts of England; in Wales; pretty generally in Scotland, and rarely in Ireland. The species is distributed throughout Europe.

This is a free-growing plant, requiring a very abundant supply of moisture, both about its roots and fronds; the soil, however, should be well drained, that this moisture may not become stagnant. It attains its fullest perfection in damp woods and near water-falls, even within range of the spray; and hence requires shade and a moist atmosphere to secure the most perfect growth under artificial circumstances. If planted on artificial rockwork, it should

be placed where these conditions may be secured, and where it will also enjoy shelter in other respects. As a pot plant, it is a very delicate object; and should be planted in well-drained pots of turfy peat soil, mixed with decayed tree leaves, charcoal, and sand. In the summer season it grows best in a cold frame, shaded from bright sunshine; and it may be induced to grow in winter, by the application of heat, which it stands well. The spray of a water-fall, in which the plant delights, may be imitated, by suspending a vessel of water over the plants; this, if furnished with a coarse worsted-thread siphon, will supply a succession of water-drops, which should fall on a stone near the plant, which will thus become constantly sprinkled. It may be increased by separating its creeping caudex.

3. *Polypodium Dryopteris*, Linnæus (tender three-



POLYPODIUM DRYOPTERIS.

branched Polypody, or Oak fern); frond ternate glabrous, branches pinnate: pinnae pinnatifid with obtuse lobes, uppermost pinnae nearly entire.—DESC : *Polypodium Dryopteris*, Linn. Sm. Eng. Fl. iv. 269. Newm. Brit Ferns 2 ed. 123. Bab, Manual 2 ed. 409. Hook. Brit. Fl. 5 ed. 437. Franc. Anal. 3 ed. 24. *Polystichum Dryopteris*, Roth. *Lastrea Dryopteris*, Newm. p. 13.—FIG : Eng. Bot. 616. Newm. 123. Franc. pl. 1, fig. 4 and 5 (bad).

The tender three-branched Polypody has a dark-coloured slender caudex, which is undulated, widely creeping, “ often when long established, forming a dense matted mass;” it is slightly scaly, throwing out black fibrous roots. The vernation of the fronds is very peculiar, forming an excellent diagnostic, as appears to have been first pointed out by Mr. Newman; the divisions are rolled up separately, so that the young undeveloped fronds resemble three little balls set on slender wires. The fronds grow up in March and April, soon arriving at maturity, and entirely perishing before winter. They are bright green, smooth, and delicate, and, including the stipes, from six to twelve inches high. The stipes is usually two-thirds of the height of the frond; slender, brittle, dark-coloured, and quite smooth, except in having a few scattered scales near the base. The frond is three-branched, each branch being triangular, and attached by a distinct stalk-like portion of the rachis, to the common stem or stipes; the central branch is the largest, its rachis being deflexed, the others stand at an obtuse angle. All the branches thus become loosely spreading, and they have also a drooping character, so as to be convex above; when laid out flat, Sir J. E. Smith observes that the frond is nearly pentagonal. Each branch is pinnately divided at the base, and pinnatifid at the apex; the pinnae are usually opposite, and are themselves pinnate at the base, then pinnatifid, and acute and nearly entire at the apex: the pinnules seated at the base of the pinnae, close to the principal rachis, are so placed, that when the pinnae are exactly opposite, four pinnules are brought together, and stand somewhat in the form of a cross, the two towards the apex of the branch being nearly parallel, and smaller than the other two which are diverging; the pinnules and ultimate lobes are oblong and obtuse. Some of the

fronds are more compoundly divided, the pinnules, instead of being serrated as in the case of ordinary examples, being in some degree pinnatifid, and when in this state the venation becomes also more compound. In ordinary cases, each pinnule, or ultimate lobe, has a tortuous mid-vein, from which the lateral veins branch out alternately, extending quite to the margin, and bearing the sori, near their extremity; in the more compound states of the frond the lateral veins are branched. In some cases the sori are numerous, and form a crowded line near the margin; in other examples they are few and scattered. The fructification is mature in June and July.

This species is moderately abundant, but almost entirely confined to wild and mountainous rocky districts, damp woods, and the neighbourhood of waterfalls. In England it chiefly occurs in the northern districts; and in Wales and Scotland it is pretty generally distributed; in Ireland it is the most rare of all our ferns. It occurs throughout Europe, in Northern Asia, in Africa, and in North America.

This species appears to be a moisture-loving plant, and also a lover of shade and shelter; indeed its delicate texture would render it liable to injury if much exposed. It is, however an excellent dwarf rock fern, and may be treated in all respects similarly to *P. Phegopteris*. In pot culture it is a very free-growing plant, in a well drained soil of turfy peat and charcoal. It may be readily increased by the process of root division, or rather by the division of its creeping caudex.

4. *Polypodium calcareum*, Smith (rigid three-branched Polypody, or Smith's fern); fronds sub-ternate glandular-mealy, lower branches pinnate: pinnae pinnatifid with obtuse lobes, uppermost pinnae nearly entire.—DESC : *Polypodium calcareum*, Sm. Fl. Brit., 1117 (1804). Sm. Eng. Fl. iv. 270. Newm. Brit. Ferns 2 ed. 131. Bab. Manual 2 ed. 409. Hook. Brit. Fl. 5 ed. 437. Franc. Anal. 3 ed. 24. *Polypodium Robertianum*, Hoffm (1795). *Lastrea Robertiana*, Newm. p. 13.—FIG : Eng. Bot. 1525. Newm. 135.

The rigid three-branched Polypody has a dark brown creeping flexuous caudex, rather stouter and less extended than in *P. Dryopteris*; from this the fibrous roots are thrown out.

The young fronds in their vernation have all their pinnae rolled up separately into little roundish balls. They grow up in May, and attain full development in the midst of the summer season. They are deep green, firm in texture, about the size of those of *P. Dryopteris*, but much more upright than in that species, all the three divisions being rigid and erect, and without the marked deflexure of



POLYPODIUM CALCAREUM.

the rachis. The stipes is stouter, more abundantly scaly about the base, and clothed with very minute stalked glands, giving a mealy character to the surface, as is more or less

the case over the frond; this character is an excellent diagnostic. The frond is of a nearly triangular form when expanded the base often shorter than the sides; it is partially three branched, but the two lateral branches are small compared with the central one, and are more like enlarged pinnae than distinct divisions, as in the last species. The pinnae are opposite, the lower pair being attached to the main rachis by a short stalk-like portion of their rachis, "but this is always shorter, and more slender than the main rachis between the first and second pair" of pinnae: the lower pinnae are pinnate, their lower pinnules being again deeply pinnatifid, and gradually less so towards the point of each pinna; the upper pinnae also become gradually pinnatifid; the second pair from the base is frequently attached by short stalks, but not invariably so, and the rest are sessile. The ultimate divisions of the frond have a distinct mid-vein; in the smaller lobes the lateral veins are simple, in the larger ones they are slightly branched, the sori being produced near the termination of the main lateral vein. The sori thus forms a marginal series, more or less crowded, and often become confluent in age. The fructification is matured in August.

This species is rare and local, confined to limestone districts, chiefly in the northern and western parts of the island, where it occurs growing among rocks in exposed mountainous tracts. It is altogether a more hardy plant than *P. Dryopteris*, with which it is closely allied, sufficiently distinguishable, however, by the mode of vernation, the composition of the frond, and its glandular-mealy surface. It is met with in some other parts of Europe besides England, and also in North America.

Somewhat more shy under cultivation than the last. To the turf-peat which forms a good basis of the compost for ferns, a portion of chalk, limestone, old mortar, or broken freestone, should be added, as well as the broken charcoal and the sand; the pots too must be especially well drained or the plant soon dies. It does not require, nor is benefited by so much shade as the two last species enjoy. It is increased by dividing its creeping caudex.

GENUS II.

A L L O S O R U S.

ALLOSORUS, *Bernhardi*.—Mid-vein distinct, lateral veins free, often divided; sori circular, at length confluent, attached near the extremity of lateral veins, covered by the bleached reflexed margin of the frond. Name derived from the Greek *allos* (various), and *sorus* (a heap), in allusion to the altered appearances of disposition presented by the sori in the stages of their development.

One species only of this genus, is an inhabitant of Britain, and this is a very elegant little plant, somewhat resembling parsley. It assumes two or three distinct forms which I have regarded as varieties. These varieties are probably induced by the circumstances of their growth, as they are more or less connected by intermediate forms.

The genus has doubtless considerable affinity with *Pteris*, from which however the detached spore-cases readily distinguish it, in the earlier stages of development.

1. *Allosorus crispus*, Bernhardi (rock Brakes, or mountain Parsley); fronds of two kinds, 2-3 pinnate; ultimate divisions of barren fronds, wedge-shaped often bifid at the extremity; of the fertile ones, linear-oblong.—DESC: *Allosorus crispus*, Bernh. Bab. Manual 2 ed. 408. Newm. Brit. Ferns 103. *Osmunda crispa*, Linn. *Pteris crispa*, Linn. M.S. Sm. Eng. Fl. iv. 306. *Cryptogramma crispa*, R. Br. Hook. Brit. Fl. 5 ed. 444. Franc. Anal. 3 ed. 57.—FIG: Eng. Bot. 1160. Newm. 103. Franc. pl. 6. fig. 2.

β *dentatus*; barren fronds—ultimate divisions oblong-oval, the margin sinuate-dentate, feather-veined; fertile fronds—ultimate divisions roundish-oblong.

γ *linearis*; barren fronds—ultimate divisions narrow linear, cleft at the apex; fertile fronds—ultimate divisions oblong.

The rock Brakes is furnished with a procumbent caudex, producing numerous fibrous roots, and a tuft of fronds from its crown. The young fronds spring up in May and June, and attain maturity by the end of the summer, disappearing at the commencement of winter. The fronds are nearly triangular in outline, and from four to eight and sometimes twelve inches high. The stipes is long, slender pale-coloured, and smooth. The barren fronds are bi-tri-pinnate, the pinnae, pinnules, and lobes being alternate;



A. crispus, vars.

the ultimate divisions are wedge-shaped and cleft; or, in the variety *dentatus*, oblong-oval, with an evenly sinuous-toothed margin; in *linearis*, narrow linear and cleft at the end: they are of a delicate pea-green colour, and the lobes are often crowded and elegantly crisped. The fertile fronds are slightly taller than the barren ones, also bi-tri-pinnate, the ultimate divisions being of a more or less elongated-oblong, or of an oval figure, and stalked, with a distinct flexuous mid-vein, from which the alternate (often forked) lateral veins are produced; these lateral veins do not reach the margin; each branch usually bears a nearly circu-

lar sorus near its extremity. The sori are without an indusium, but are concealed by the reflexed bleached margins of the divisions which nearly meet over the midrib;

***ALLOSORUS CRISPUS.***

they soon become confluent, which led Sir J. E. Smith to describe them as forming two dense linear masses. The fructification is mature in August and September.

The species is comparatively rare and local. It is a rock plant occurring chiefly on mountain sides in rough stony places, but occasionally locating itself on old walls. It is

most abundant in the northern districts of England, and in some of the Welsh counties; in Scotland it is widely but sparingly distributed; and in Ireland it is very rarely met with. The variety which I have called *dentatus* I possess from Falcon Clints (Mr. Simpson), and the same form exists in the herbarium of the Botanical Society of London, from Coniston, the Sidlaw hills, and Clurger Dean near Todmorden. I also find in the same herbarium a form of the plant from Ambleside, in some measure connecting this with the normal form. The variety *linearis* is met with on Snowdon. In its geographical range, the species appears to be almost if not entirely European.

This little fern is a free-growing species under cultivation, and a very elegant ornament of rock work. It is naturally a stone-loving plant, growing among loose boulders, and sometimes on old walls. Hence it is well adapted by its natural habits for planting on masses of artificial rock-work. It also succeeds remarkably well under pot culture. When growing in pots it should have a well-drained soil, and there is no better compost for it than a compound of turf peat, good free loam, broken potsherds, and small lumps of charcoal intimately blended in the proportion of two parts of each of the two former, to one part of each of the latter. When planted out on rockwork, it should be fixed in situations where while freely supplied with water at the root, all superfluity may soon drain away. It does not especially require shade, although it grows best when shaded; and indeed under artificial culture, the delicate texture for which the ferns are generally so much admired, is favoured by a moderate degree of shade. The potted plants must be kept drier in winter than in summer; in the latter season they ought to be pretty freely supplied, the moisture, however, should never become stagnant about them. Though the present species often grows in situations, where it is necessarily subjected to a considerable degree of aridity, and is also much exposed to sunlight, it may, under cultivation, be grown to a finer state of development if kept moderately moist, and shaded during the period when its growth is taking place. In its native localities it seems sometimes to derive the most of its support from the atmosphere; for I am informed, that on removing the loose boulder stones among which it grows, it is often found without apparently the least particle of soil attached to the roots. It is propagated by division of the plant.

GENUS III.

W O O D S I A.

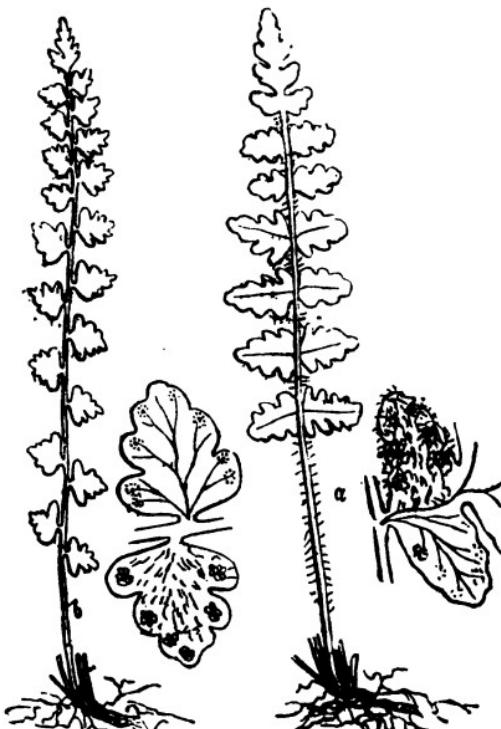
WOODSIA, *R. Brown*.—Mid-vein not very distinct, lateral veins branched, free; sori circular attached near the extremity of lateral veins, with an inferior involucrum the margin of which is divided into numerous jointed capillary segments.—Name given in compliment to Joseph Woods, Esq., a clever botanist, and author of an excellent monograph of the British Roses.

A difference of opinion exists as to the specific value of the variation between the indigenous plants referrible to this genus. Bolton, Smith, Wahlenberg, Hooker, and Wilson; amongst others, regard them as distinct species. Babington gives them as varieties of one species, and Brown has expressed, and Newman implied a doubt of their specific distinctness. My own observation of the plants would rather lead to the former opinion, and, indeed, the appearance of the plants, in every stage of development, is very different. It is indeed stated that Mr. Backhouse, jun., has transplanted roots agreeing in every particular with *Woodsia ilvensis*, the first fronds produced by which assumed exactly the form of *Woodsia alpina*, and afterwards changed back to their original state; others, however, find the two plants constant under cultivation.

Analysis of the Species.

- | | |
|----------------------------------|-------------------------|
| Pinnæ oblong, deeply lobed . . . | 1. <i>W. ilvensis</i> . |
| bluntly triangular, lobed . . . | 2. <i>W. alpina</i> . |

1. *Woodsia ilvensis*, R. Brown (oblong, or Ray's Woodsia); fronds pinnate lanceolate, with numerous chaffy hairs beneath; pinnae oblong, deeply pinnatifid, with bluntly ovate sometimes crenated lobes; stipes and rachis chaffy.—DESC: *Woodsia ilvensis*, R. Br., Lin. Soc. Trans. xi, 173. Sm. Eng. Fl. iv. 309. Bab. Manual, 2 ed. 409. Newm. Brit. Ferns, 2 ed. 137. Hook. Brit. Fl. 5 ed. 437. Franc. Anal., 3 ed. 26. ?*Acrostichum il-*



a. WOODSIA ILVENSIS; b. W. ALPINA.

vense, Linn. ? *Polypodium ilvense*, Swartz.—FIG : Newm. 137 (good). Eng. Bot. Supp. 2616. Franc. pl. 1, fig. 6, A (bad).

The oblong Woodsia has a thick tufted caudex, from which the blackish-smooth wiry roots are produced. The deciduous fronds, which are pinnate and broadly lanceolate in figure, are tufted, and vary from two to six, but seldom exceed four inches in height. They are somewhat coriaceous, appearing smooth above when mature, but in reality, as seen when magnified, sparingly clothed with bristle-like scales, which, together with shining jointed hairs, are much more abundant on the veins beneath; they are also numerous on the rachis. The stipes is distinctly articulated, or jointed, at a short distance from its junction with the caudex, the articulation being swollen; at this point the natural separation of the frond appears to take place, the basal portion remaining attached to the caudex, and the upper portion falling away; the stipes both above and below this articulation—a character common to a section of the genus—is thickly clothed with the scales already noticed. The pinnae are usually opposite; they are oblong obtuse broadest at the base, sessile, deeply lobed or pinnatifid with many ovate-oblong obscurely crenated segments. The mid-rib of these ultimate divisions is somewhat indistinct the lateral ones being free, sometimes branched and sometimes simple, extending to near the margin, in which position the sori, when present, are produced, thus forming a marginal series; they are circular and distinct in the young state, but in maturity become more or less confluent. The sori are often almost concealed by the hairiness already spoken of, and by the capillary segments of their involucres; this hairiness consists first, of very long, pointed, narrow scales, which are more particularly abundant about the mid-rib; secondly, of jointed, shiny hairs, which are scattered nearly over the whole surface; and thirdly of the capillary segments of the involucres themselves, which are also jointed and shining. The fructification is mature in August and September; afterwards, on the approach of frost, the fronds die down, and are renewed in spring.

This is one of the rarest of our indigenous species, growing in exposed rocky alpine regions, and there very sparingly. The Falcon Cliffs, a series of bold basaltic rocks

in Teesdale, Durham; a moist rock called Clogwynn-y-Garnedd, one of the highest peaks of Snowdon, and Llynn-y-cwn, on Glyder Vawr, in Wales; and the Clova mountains in Scotland, are the chief recorded localities. In these places it grows sparingly, rooting into the crevices of the dripping rocks. It occurs in the most northern parts of the northern hemisphere as far as Greenland.

2. *Woodsia alpina*, Newman (alpine, or Bolton's Woodsia); fronds pinnate linear-lanceolate; pinnae bluntly triangular pinnatifid with rounded lobes usually entire.—DESC: *Woodsia alpina*, Newm. Brit. Ferns, 2 ed. 143. *Woodsia hyperborea*, R. Br., Linn. Soc. Trans. xi, 173. Sm. Eng. Fl. iv. 310. Hook. Brit. Fl., 5 ed., 437. Franc. Anal. 3 ed. 27. *Woodsia ilvensis* var., Bab. Manual, 2 ed. 409. *Acrostichum alpinum*, Bolton (1790). *Acrostichum hyperboreum*, Liljeblad (1793). *Polypodium hyperboreum*, Swartz. *Polypodium arvonicum*, Withering, and Sm. Fl. Brit.—FIG: Newm. 143 (good). Eng. Bot. 2023. Franc. pl. 1. fig 6, B.

This species is certainly nearly allied to the last. Two forms are distinguished by Babinson— β . *gracilis* with linear lanceolate fronds, triangular pinnatifid pinnae, with 5—9 oval lobes, which are entire, or the lowest one crenate (*Woodsia hyperborea*, Eng. Bot.; *Polypodium hyperboreum* β . *gracile*, Wahl.); and γ . *alpina* with oblong fronds, triangular oval pinnae, with 3—5 rounded very blunt lobes (*Polypodium hyperboreum*, Wahl.; *Acrostichum alpinum*, Bolt.)

The alpine Woodsia has a thick tufted caudex, from which are protruded the blackish wiry roots. The fronds which die down annually, growing up again in spring, are narrow, almost linear, pinnate; generally taller, and more tender and membranous than the last, according to Hooker; they are also usually glabrous, or nearly so, though sometimes the stipes, rachis, and veins beneath, are slightly hairy, mixed with a few pale chaffy scales, which are chiefly present in the young state, and apparently very easily displaced. The stipes is articulated as in the last species. The pinnae are triangular with the angles rounded, less deeply pinnatifid than in the last; the lobes, 5—7 in number, are broadly ovate and entire, the first superior lobe

sometimes considerably larger than the rest; these pinnæ are usually alternate, the lower ones distant and gradually becoming smaller from near the middle. Newman thus describes the venation:—"No particular vein appears to possess a very decided superiority over the others; they are occasionally simple, but generally divided into two or three branches; they do not quite reach the margin of the pinnæ." The sori, when present, are placed at the extremity of the veins; they are larger, in consequence of the presence of more numerous spore cases, than in the last, and often become confluent. The fructification is mature in September.

This is equally rare with its kindred species, and has been discovered only in the wildest and most inaccessible mountain regions. It has been found on moist rocks facing the east on Clogwynn-y-Garnedd, one of the highest peaks of Snowdon, in Wales; and on Ben Lawers, Craig-Chal-liach, and Mael-dun-Crosk, in Scotland. It is met with rarely in the arctic and sub-arctic countries, and still more rarely in the mountainous parts of the temperate regions, of the northern hemisphere.

The Woodsias have no especial claim to be esteemed for their elegance; they are, however, highly prized for their rarity. They are best cultivated in moderate sized pots, potted high amongst turfy peat, charcoal, freestone, and sand; and kept in a cold frame, which should face the north in the summer season, and should at no time be kept constantly closed up. Under cultivation they are very impatient of sunshine and stagnant moisture. The plants may be advantageously elevated a little between three small pieces of freestone, the soil being carefully placed about their roots. They must not be kept too damp, especially on the approach of and during the continuance of winter. A shady shelf in a cool greenhouse, where there is a free circulation of air, is a good situation in which to preserve them during the dormant season. The tufts should be occasionally divided, the plants being more liable to perish from "damping" off when they form large masses, than when of smaller size; this should be done very carefully in spring about the time they commence their seasonal growth.

GENUS IV.

L A S T R E A.

LASTREA, *Presl*.—Mid-vein distinct, lateral veins simple or branched free; sori nearly circular indusiate attached at the back of the lateral veins: indusium irregularly reniform, attached by the sinus.—Name applied in honour of M. Delastre, of Chatelleraut, a zealous botanist, and an excellent microscopic observer.

The name borne by this genus was first applied by Bory de St. Vincent to a group of the old genus *Polypodium*, including *Oreopteris*, *Thelypteris*, *Phegopteris*, *Dryopteris*, and *calcareum*; and was subsequently adopted, and its limits restricted by Presl. As it now stands, it embraces the greater part of the British species which were formerly referred to *Aspidium*. The common male fern (*Lastrea Filix-mas*) may be regarded as the typical species. The members of the group allied to *Lastrea dilatata*, which are abundant in many localities have not been generally well understood, and deserve a more close investigation. Of modern authors, Newman, following Bory, places in this genus three species—*Phegopteris*, *Dryopteris*, and *calcarea*—which are more commonly referred to *Polypodium*, from which they had been, however, removed to *Polystichum* by Roth, who regarded them as having indusia, a view which the observations of others do not appear to favour. Many of the *Lastreas* are of exceedingly elegant habit.

Analysis of the Species.

Sori on either branch of lateral veins; fronds pinnate.

not glandular beneath

Sori on anterior branch of lateral veins.
fronds pinnate, pinnae short triangular.

branches fronds sub-bipinnate, pinnæ lanceo-

bi-tri-pinnate pinnules without spinulose serrations with spinose-mucronate

pinnae with spinose-nucleate scales of stripes bordered with fringe.

scales of stipes lanceolate, entire, indus-

acinated,
minute se

not glandular	1. <i>L. Thelypteris</i>
glandular beneath	2. <i>L. Oreopteris</i>

terior branch of lateral veins.
pinnate, pinnae short triangular, lateral veins with several

3. *L. cristata*.
4. *L. Filix-mas*

bi-tri-pinnate pinnules without spinulose serratures, glandular pinnules with spinose-mucronate serratures

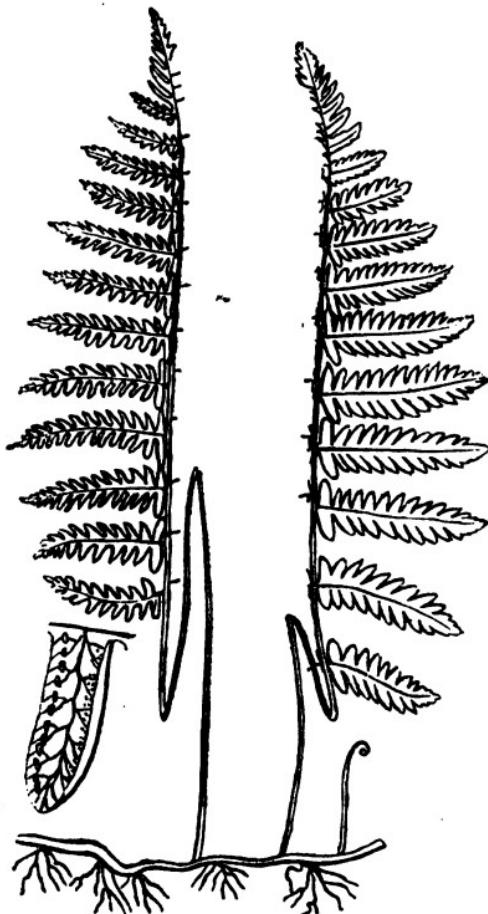
... 5. *L. rigida*.

L. sinuosa scales of stipes broadly ovate, indusium entire not fringed with glands.

scales of stipes lanceolate.
entire, indusium fringed with stalked glands 7. *L. dilatata*.

laciniated, indusium jagged and beset with minute sessile glands 8. *L. Farnesii*.

1. *Lastrea Thelypteris*, Presl (marsh Fern); fronds of two kinds, lanceolate pinnate: pinnæ linear-lanceolate



LASTREA THELYPTERIS.

deeply pinnatifid, without glands ; lobes oblong, those of the fertile fronds with revolute edges.—DESC : *Lastrea Thelypteris*, Presl. Newm. Brit. Ferns, 2 ed. 183. Bab. Manual, 2 ed. 409. *Aspidium Thelypteris*, Swartz. Sm. Eng. Fl. iv. 272. Hook. Brit. Fl. 5 ed. 439. Franc. Anal. 3 ed. 35. *Polypodium Thelypteris*, Linn. *Acrostichum Thelypteris*, Linn. *Polystichum Thelypteris*, Roth.—FIG : Newm. 183. Franc. pl. 3, fig. 1. The plate in Eng. Bot. (1018) represents *Polypodium Phegopteris*.

The marsh Fern has a very widely and rapidly extending creeping caudex, which is slender, dark coloured, and nearly smooth, with densely matted fibrous roots. The fronds perish annually, and are renewed—the barren ones about May, the fertile ones about July. They are slender and fragile, quite erect, from six to eighteen inches high, smooth, delicate, almost membranous, and usually of a pale green colour. The stipes is slender and smooth. The fronds are lanceolate and pinnate ; the pinnae generally opposite, but sometimes alternate, distant, slightly drooping, and pinnatifid, with crowded entire rounded lobes. The fertile fronds are similar to the barren ones, but taller and more robust; a specimen in the herbarium of the Botanical Society of London, collected by Mr. Woodward, on Holt Heath, Norfolk, is upwards of three feet high, with distant alternate pinnae occupying the upper third of the frond ; these fertile fronds have the margin of their lobes revolute, and the lobes thus acquire the appearance of being narrower and more pointed than those of the barren fronds. The mid-vein of the ultimate lobes is distinct, and somewhat sinuous, with free alternate lateral veins, which usually become forked near the mid-vein, the branches being continued to the margin ; in weak garden specimens I find some of the veins simple, and in more luxuriant ones sometimes with more than two branches; each branch usually bears at about half way between the margin and mid-vein a small roundish sorus. The sori thus form a submarginal line ; they finally become confluent, or nearly so, and partially covered by the reflected margin of the lobe. The young sori are covered by thin white reniform indusia, which soon become pushed aside and lost. The fructification is mature in September.

This species is rather rare, and local, though general, in its distribution. It is only found in boggy and marshy places, and is generally when present abundant, being a free grower, and rapidly extending itself by its long creeping caudex. In England and Wales it occurs in numerous localities, but both in Scotland and in Ireland it is uncommon. It is found throughout Europe, and both in Asia, Africa, and America.

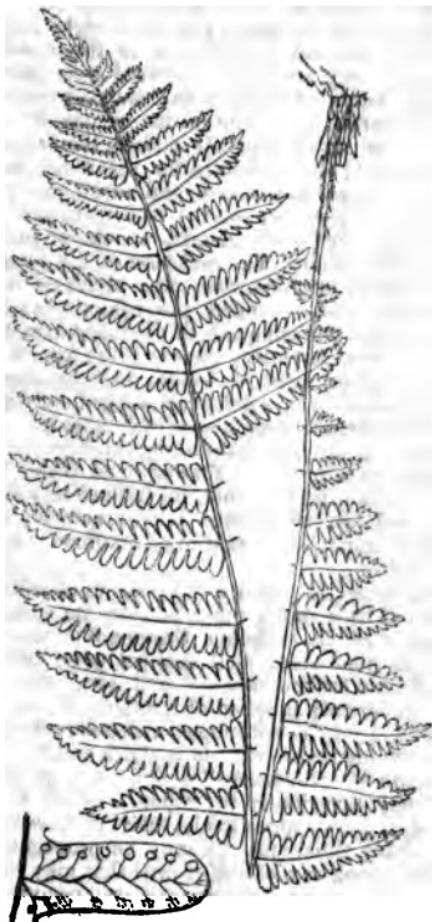
Under pot-cultivation this is a very free growing species if potted in turf-peat soil, mixed with decaying tree leaves and some charcoal, and kept in a moist state. Though growing freely it does not very readily produce its fertile fronds when kept in pots; it is nevertheless an elegant and delicate looking species. Probably its want of fertility may be in consequence of its extensively creeping stems being too much restricted. A wide, shallow pan would, in this respect, be more congenial to its habits than the more usual form of a garden pot. If introduced about rock-work it should be at the base, where its natural boggy habitat may be imitated; under such conditions it will grow very freely. It propagates readily by division of the caudex.

2. *Lastrea Oreopteris*, Presl (mountain or heath Fern); fronds lanceolate pinnate: pinnae linear-lanceolate deeply pinnatifid, sprinkled with glands beneath; lobes oblong flat.—DESC: *Lastrea Oreopteris*, Presl. Newm. Brit. Ferns, 2 ed. 188. Bab. Manual, 2 ed. 410. *Aspidium Oreopteris*, Swartz. Sm. Eng. Fl. iv. 273. Hook. Brit. Fl., 5 ed. 439. Franc. Anal., 3 ed. 36. *Polypodium montanum*, Vogler* (1781). *Polypodium Oreopteris*, Ehrhart (1787). *Polystichum montanum*, Roth.—FIG: Eng. Bot. 1019. Newm. 187. Franc. pl. 3. fig. 2.

The mountain Fern has a large tufted scaly caudex, from which spread in all directions numerous strong, entangled fibres. The fronds appear in May, and are numerous and semi-erect, rising up from the crown of the caudex,

* Vogler's description is excellent. His name (*montana*) has a good claim to preference over Ehrhart's (*Oreopteris*), now generally followed. The reasons which prevented its adoption when both this plant and the *Polypodium montanum* of Allioni (*Cystopteris montana*) were regarded as *Aspidiums*, do not apply now that they are found to belong to widely differing genera.

two or three feet high; they are lanceolate and pinnate, leafy nearly to the bottom, and remarkably narrowed there,



LASTREA OREOPTERIS.

the pinnae gradually decreasing in size from about the middle of the frond. Newman notices, as a peculiarity in the mode of their vernation, that "immediately they begin to unroll, they exhibit the pinnae placed at right angles with the main stalk, and not convolute as in the allied ferns." The stipes is very short, and covered with pale brown scales, a few scattered scales also occurring on the rachis among the lower pinnae. The pinnae are usually opposite, attached to the rachis by their midrib, linear acute and deeply pinnatifid; the midrib is, for the most part, finely downy; the lobes are flat, obtuse, and entire, rarely slightly crenate at the extremity; on the under surface are scattered numerous yellowish glands, which, when bruised, emit a powerful odour. The mid-vein of the lobes is distinct and slightly sinuous, with free alternate branches, which are sometimes branched and sometimes simple, all extending nearly, but not quite, to the margin, and bearing the sori near their extremity; the sori thus form a crowded sub-marginal series, and at length become nearly confluent; the indusium is small, thin, jagged and soon obliterated. The fructification is mature in August.

This species is an inhabitant of mountainous heaths and of woods, and is common in England and Wales, and particularly abundant in Scotland; in Ireland it is altogether more local and less abundant. It is, moreover, met with throughout Europe, but is said to be confined to this quarter of the globe.

It is considered as rather a shy plant to establish under cultivation, at least much more so than its commonness would seem to render probable. Under pot culture it should be placed in good-sized well drained pots, among turfy peat mixed with broken charcoal and sand, and must be kept only moderately supplied with water. It is a very elegant plant, and may be introduced with good effect in shady situations, among rockwork. It is also a suitable plant for the decoration of "wilderness" walks, as it grows beautifully, and very luxuriantly in woods. When it becomes established, it grows more freely, thriving, however, much better in shady situations. It may be propagated, sparingly, by detaching any lateral crowns that may be formed around the old plants. It grows very freely from the spores.

3. *Lastrea cristata*, Presl (crested or Ehrhart's Fern);

fronds linear-oblong pinnate: pinnae triangular-oblong short deeply pinnatifid with oblong serrated lobes, the lower crenately often deeply lobed; lateral veins of the



LASTREA CRISTATA.

lobes with several branches.—DESC: *Lastrea cristata*, Presl. Newm. Brit. Ferns, 2 ed. 203. Bab. Manual, 2 ed. 410. *Aspidium cristatum*, Swartz. Sm. Eng. Fl. iv. 276. Hook. Brit. Fl., 5 ed. 439. Franc. Anal.: 3 ed. 39. *Polypodium cristatum*, Linn. (in part). *Polyopodium Callipteris*, Ehrh. (1788). *Polystichum cristatum*, Roth.—FIG: Eng. Bot. 2125. Newm. 203 (good). Franc. pl. 3 fig. 4.

The crested Fern has a stout tufted *caudex*, which "gradually increases in length as the plant increases in age, occasionally emitting a lateral branch, which in due time also becomes branched, so that an old plant is sometimes possessed of a very extensive and complicated" *caudex*; from this, numerous dark brown matted roots are produced. The fronds are pinnate from one to two feet high, and grow up in May, in a small tuft from each crown; they are remarkably narrow-linear-oblong in their entire outline, but not narrowed towards the base. In the mode of their vernation, they somewhat resemble *L. Oreopteria*, the fronds being rolled up circinate, with the pinnae perfectly flat, lying one pair upon another. The stipes occupies one-third or more of the height of the fronds, and is very stout, shining, and furnished, especially towards the bottom, with large scattered broad obtuse membranaceous light brown uniformly-coloured scales: of the older fronds the bases of the stipes, which retain their vitality for many years, exhibit numerous rude semi-lunar markings, indicating the points of the former attachment of the scales. The pinnae—which are produced in pairs, but seldom exactly opposite, those towards the apex of the fronds becoming decidedly alternate, and are rather distant, the distance decreasing from the base towards the apex—are attached to the rachis by a short stalk, and are short as compared with other species, yet of an elongate triangular figure, deeply pinnatifid so as to become almost bipinnate; the lobes are ovate oblong blunt, almost invariably decurrent at the base; sometimes those next the rachis are very slightly stalked, and they are usually more or less deeply lobed, all the lobes being sharply and finely toothed, and often bristled. In luxuriant fronds the pinnae are somewhat more elongated than ordinary. The mid-vein of the lobes is very sinuous; the lateral veins have several branches, one of which only, the anterior one, bears

a sorus which is situated about midway between the mid-rib and the margin in a more or less distinct line, in luxuriant specimens crowded and becoming confluent, and usually either confined to or most abundant on the upper part of the frond; sometimes, however, the fructification extends down to the second pair of pinnae from the base. The sori are covered by a reniform indusium, which is somewhat irregular on the margin, and attached by a deep sinus on the side towards the main rib of the pinnae. The fructification is mature in September.

This species is extremely local in the British Isles, and is found only on boggy heaths, attaining its greatest luxuriance where slightly shaded. The recorded stations for it are Edgetield, Bawsey Heath, Dersingham, Fritton, and Holt Heath in Norfolk; Westleton in Suffolk; Oxton Bogs and Bulwell Marshes in Nottinghamshire; and Wybunbury Bog in Cheshire. It is more common on the continent of Europe, and also throughout the North American United States.

It is a free but not very elegant species under cultivation, growing readily in turf peat soil, if kept well supplied with water. It succeeds well in an artificial bog at the base of a piece of rockwork. When grown in a pot, it should have one of tolerable size, and must be well supplied with water. The pots may be plunged in a somewhat sheltered spot for the winter. It likes a moderate degree of shade.

4. *Lastrea Filix-mas*, Presl (Male Fern); fronds broadly lanceolate sub-bipinnate: pinnae linear-lanceolate; basal pinnules more or less distinct, the rest confluent all oblong, crenato-serrate or with toothed incisions; lateral veins of pinnules simply forked or 3-many branched; sori in a proximate line on each side of mid-vein; indusium entire, very persistent, without glands.

a. —; pinnules obtuse-oblong, crenato-serrate, their lateral veins simply forked or sometimes 3-branched; sori confined to lower half of pinnules — DESC. : *Lastrea Filix-mas*, Presl. Newm. Brit. Ferns, 2 ed. 197. Bab. Manual, 2 ed. 410. *Aspidium Filix-mas*, Swartz. Sm. Eng. Fl. iv. 275. Hook. Brit. Fl. 5 ed. 440. Franc. Anal. 3 ed. 38. *Polyodium Filix-*



LASTREA FILIX MAS.

mas, Linn. *Polystichum Filix-mas*, Roth.—FIG: Eng. Bot. 1458. Newm. 197. Franc. pl. 3. fig. 3.
B. incisa; robust; pinnules elongate and (especially)

(those next main rachis) regularly divided by deep incisions, the lobes more or less serrated; lateral veins many branched; sori extending nearly the entire length of the pinnules.—DESC : *Lastrea erosa*, Deakin Florigraph. Brit. iv: 101. *Aspidium depastum*, Schkuhr, appears to be a monstrous state of this variety.—FIG : Florigraph. Brit. fig. 1608. Newm. 197.

γ. *abbreviata*; small; sori confined to base of contracted or obsolete pinnules forming a linear series on each side midrib of pinnae.—DESC : *Polystichum abbreviatum*, De Candolle (according to Newman and Babington). ? *Aspidium Felix-mas recurvum*, Francis.

δ. *variegata*; fronds variegated, white and green.

A monstrous form of the var. *incisa* in the Herbarium of Botanical society of London (from King's Cliff Valley, near Bridgewater, Mr. Clark) has the pinnules very irregularly and deeply cleft, and manifests an indication of becoming forked at the extremity of the pinnae, in whch state it very closely coincides with Schkuhr's *Aspidium depastum*.

A curious form (from near Woolwich, Dr. Bossey) in Herb. Bot. Soc. though fruitful has the lobes of the pinnae depauperated, giving the pinnae the appearance of the leaves of *Comptonia asplenifolia*. I am not aware to what extent this form has been observed; probably merely an individual plant which had been affected by local causes.

The Male Fern has a large tufted scaly caudex, from which proceed numerous strong dark brown, deeply penetrating roots; this caudex becomes gradually elongated, and this in aged plants often elevates the crown above ground; sometimes, however, it assumes a pendent position, the crown becoming curved at the extremity, from which the fronds arise, nearly or quite erect. The fronds grow up several from the crown in a circle; they rise to the average height of from two to three feet, and are leafy to within about a third of the length from their base, where they are densely covered with pale-coloured membranous chaffy pointed scales of various sizes; they appear in May;



Lastrea Filix-mas, var. incisa.

the vernation at first is circinate, but in a few days after their development commences, the apex becomes liberated, and curves downwards, the fronds thus acquiring a curve similar to that of a shepherd's crook. The stipes is short, and usually, together with the rachis, chaffy throughout. The fronds are sub-bipinnate, broadly lanceolate, often oblong abrupt, with an acuminate apex. The pinnæ are linear-lanceolate, acute, alternate, the lowest shorter than those about the middle of the frond, but not so much abbreviated as in the allied *L. Oreopteris*; they are pinnate at the base, the pinnules having a narrow attachment, but scarcely stalked; in the rest of the pinnæ the pinnules are usually more or less combined at the base, most so in the variety *abbreviata*, but less so in the variety *incisa* than in the normal state, in which latter the pinnules and lobes are of an oblong-obtuse outline, crenato-serrate on the margin, and more acutely and closely serrate at the apex. In the var. *incisa*, the pinnæ are somewhat more distinctly pinnate, and they are also more elongate and narrower at the apex, the margins being more or less deeply incised or lobed, each of the lobes having from two to four or five serratures. The mid-vein of the pinnules and lobes is sinuous; the lateral veins are alternate, and they become branched near the mid-vein, in the normal plants usually simply forked or occasionally with the posterior branch again forked; the anterior branch on a greater or less number of these lateral veins at the base of the pinnule, bears a sorus just above the fork, so that the sori, in this case, form a short line on each side, near the mid-vein, extending about half the length of the pinnule. In the var. *incisa* the lateral veins are more compound, sometimes three, sometimes four, and at the base usually many branched; but the sori are only produced on the anterior branch, as in the more common plant, so that they are here also ranged in a line on each side the mid-vein; they extend, however, from the base nearly to the apex of the pinnule. In the var. *abbreviata*, on the other hand, the sori are confined to the base of the obsolete pinnules, forming a line on each side the rachis of the pinnæ. The sori are covered by smooth very persistent reniform indusia, which are connected to the back of the veins by their sinus, which is turned away from the apex of the pinnule or lobe. The fructification is mature in August, and the fronds remain for a considerable period in a perfect state.

This is one of our commonest ferns and is a very elegant one. It abounds everywhere, in wooded and in shady situations, and is common in hedge banks, especially where the soil is good. The var. *incisa* has been gathered in the respective neighbourhoods of Bridgewater, Cockermouth, and Guildford, and on the Cathcart Hills, near Glasgow. The var. *abbreviatum* has been found at Ingleborough, and is probably not uncommon in dry situations. The species is met with over the whole continent of Europe, and is widely dispersed elsewhere.

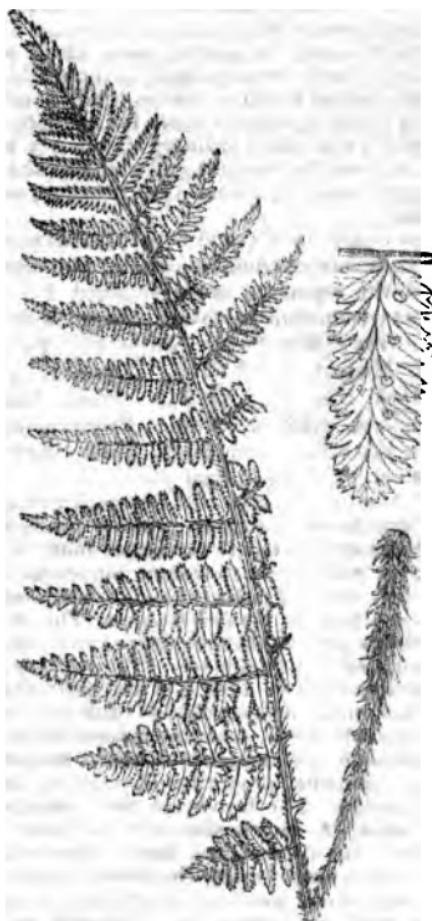
The Male Fern, in conjunction with the common bracken, is applied to various economic uses, such as the dressing of leather, the manufacture of glass, the bleaching of linen, &c.; these will hereafter be more fully noticed in treating on that species. The inhabitants of Siberia are said to boil the Male Fern in their ale to improve its flavour; and in Norway the dried fronds are infused in hot water, and thus form a palatable food for cattle, sheep, and goats, which eat it eagerly, and even fatten upon it. In the dried state it forms a warm litter for cattle, or a good light protective covering for plants; and either in the fresh or decayed state is useful as manure. Medicinally it has obtained some celebrity as an anthelmintic, in which character it was known to the ancients: it was formerly employed much more frequently than now, not, however, it appears so much on account of its inefficiency, as from the greater facility with which other and perhaps better understood agents are procured. Thus Gerarde writes:—"The roots of the male fern, being taken to the weight of half an ounce, driveth forth long flat worms, as Dioscorides writeth, being drunk in mede or honied water, and more effectually if it be given with two scruples, or two third parts of a dram of scamomie, or of black hellebore; they that will use it, must first eat garlicke." The famous remedy of Madame Nouffer, of Switzerland, for expelling tape worms has this plant for its basis. In the form of etherial extract, from 12 to 24 grains form a dose (at night and again in the morning) or from 1 to 3 drachms of the powder. The inner parts of the fresh caudex, and of the portions of leaf-stalk attached to it, which are fleshy and of a light greenish colour, should only be employed, and this should be renewed annually, and kept close from the air. This species is supposed to have been the *pteris* of Dioscorides,

according to Royle, who states that several ferns were no doubt employed medicinally by the ancients.

In cultivation it may be planted about shady walks, in woods and wilderness scenery, and on the shady sides of rockwork, in either of which situations it will flourish. As a pot plant it requires plenty of room for its roots, a loamy soil, and nothing more than ordinary attention in affording it a supply of water in summer, and plunging the pots in any loose dryish material, in almost any situation, out-doors, for the winter.

5. *Lastrea rigida*, Presl (rigid Fern); fronds narrow triangular or lanceolate glandular bipinnate; pinnules oblong blunt lobed, the segments broad rounded 2-5 toothed not spinulose; indusium persistent fringed with glands.
—DESC: *Lastrea rigida*, Presl. Newm. Brit. Ferns, 2 ed. 191. Bab. Manual, 2 ed. 410. *Aspidium rigidum*, Swartz. Hook. Brit. Fl. 5 ed. 440. Franc. Anal. 3 ed. 40. *Polyodium rigidum*, Hoffm. *Polystichum strigosum*, Roth.—FIG: Eng. Bot. Supp. 2724. Newm. 191 (good). Franc. pl. 3, fig. 5 (not good).

The rigid Fern has a large tufted caudex, with long stout roots. The fronds are numerous, growing nearly or quite erect, and attaining from one to two feet or more in height; on their upper surface are scattered numerous minute, spherical, nearly sessile glands, which are more conspicuous in the fresh than in the dried plant. The slight but peculiar, and not unpleasant scent given out by this plant is no doubt emitted by these glands. The stipes is usually from a fourth to a third the height of the frond, thickened at the base, and there densely clothed with long, narrow, very acute, reddish-brown, membranaceous scales, which become smaller and less abundant upwards, but are continued in this diminished proportion throughout the entire length of the rachis. The fronds are twice pinnate, more or less lanceolate, in some cases with the lower pinnae slightly shorter than those above them, when it is truly lanceolate, in other cases having the lowest pinnae slightly the longest, the others gradually decreasing in size upwards, when it takes a narrow and elongated triangular outline; this last form appears to be the normal state of the plant. The short lower pinnae of the lanceolate form are much broader and more distant than the upper ones,



LASTREA RIGIDA.

and have a triangular outline; the lower pinnae of the triangular form are about the same width as those of the

lanceolate form, but twice their length, and therefore much narrower in proportion. The pinnae are all short, alternate, tapering, broadest at the base of the frond, the upper ones narrowing gradually, and all pinnate. The pinnules are oblong, truncate below, usually with a short stalk-like attachment, but sometimes slightly decurrent; they are more or less deeply lobed and serrated, each segment having from two to five acute, but not spinulose teeth. The pinnules have a sinuous midvein, and alternate lateral veins, each of which is forked soon after leaving the midvein, the anterior branch bearing a sorus at about one-third the distance between the midvein and margin; the posterior branch is again divided once or twice, sending off one branch into each serrature of the margin. The sori are thus ranged in two lines, one on each side the midvein, and are usually near together, soon becoming confluent, so as to occupy the entire central portion of the pinnule; they are covered each by a persistent reniform indusium, attached to the vein by a short stalk arising from the sinus, which is turned towards the base of the pinnule; the margin of the indusium is fringed with stalked glands. The fructification is mature in August.

This is a rare and local species, entirely confined, as far as regards Great Britain, to limestone hills in the mountainous districts in the counties of Westmoreland, Lancashire, and Yorkshire. The Rev. Mr. Bree first found it at Ingleborough, in Yorkshire. Mr. Pinder also met with it in great profusion along the whole of the great scar limestone district, at intervals, between Arnside Knot, (near Silverdale, Westmoreland,) where it is comparatively scarce, and Ingleborough, being most abundant on Hutton Roof Crags and Farlton Knot, where it grows in the deep fissures of the natural platform, and occasionally high in the clefts of the rocks. It is generally much shattered by the wind, or cropped by the sheep, which seem to be fond of it. Mr. Tatham found it growing abundantly in the fissures of limestone rocks, near Settle, in Yorkshire, at an elevation of 1,550 feet. It is recorded as a native of various European countries, and of Siberia.

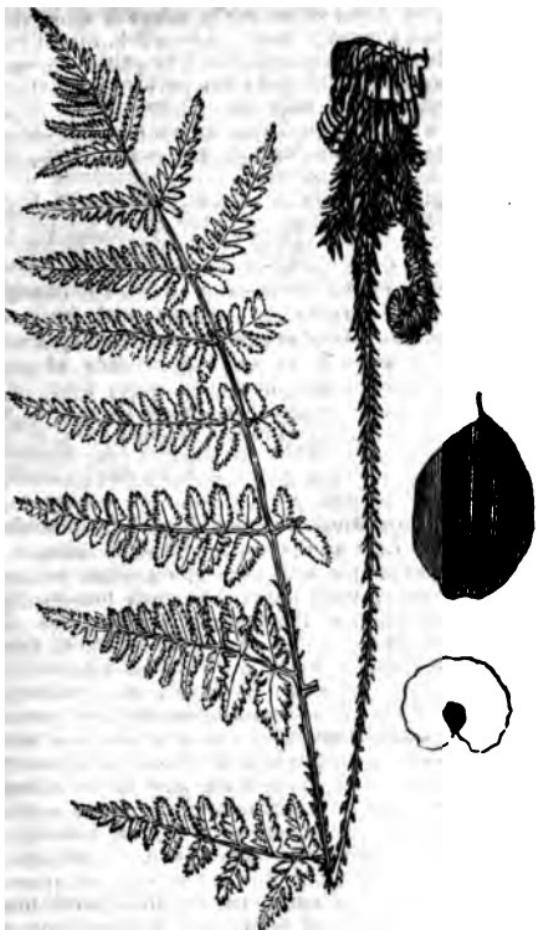
It is an easily managed and elegant plant, under cultivation, acquiring, however, under the circumstances, a degree of laxity which is not observed in the wild plant. It may be introduced to rockwork, but has nothing remark-

ably striking in its habit of growth to adapt it more than others for such a situation. In a shady peat-border it flourishes well. If grown in a pot it should be planted in turfy peat soil, intermixed with small lumps of broken limestone. It should not be kept too moist, and the crown should be kept well above the surface. It sometimes proves a rather shy plant to get established, but a shady situation is most conducive to success.

6. *Lastrea spinulosa*, Presl (narrow prickly-toothed, or Withering's Fern); fronds erect linear-lanceolate bipinnate; pinnules oblong inciso-pinnatifid with serrate spinose-mucronate lobes; indusium persistent, its margin waved but neither jagged nor fringed with teeth or glands; stipes clothed with broad ovate pale concolorous scales.—DSSC: *Lastrea spinulosa*, Presl. Bab. Manual 2 ed. 411. *Lastrea spinosa*, Newm. Nat. Alm. Id. Brit. Ferns, 2 ed. 209. *Lastrea dilatata* β *linearis*, Bab. 1 ed. *Polyodium spinulosum*, Müller (1777). Withering Arr. (1796). *Polystichum spinosum*, Roth (1800).

—FIG: Newm. 209 (good).
β. crispa; rigid, the margins of the lobes of the pinnules curled under.—*Lastrea spinosa* β . *crispa*, Deakin.

The narrow prickly-toothed Fern has a stout caudex, which gradually increases in length, becoming branched in the way of that of *Lastrea cristata*, and throwing out numerous black matted roots. The fronds grow up in April and May, and are nearly erect, and from one to two or three feet high. In vernation the pinnae are somewhat convolute. The stipes is about as long as the leafy part of the frond, and is clothed sparingly, except at the base, with bluntish or somewhat rounded scales, which terminate in a little point; they are of a uniform pale tawny colour, and almost diaphanous. The fronds are bipinnate, and of a long, narrow, that is, linear-lanceolate figure, several of the lower pairs of pinnae being of almost equal length; they are nearly erect, more so when growing in exposed places than when in woods, in the latter case becoming more luxuriant. The whole surface of the frond is flat, not convex, as in *Lastrea dilatata*, nor concave, as in *Lastrea freniseekii*. Several of the lower pairs of pinnae are usually of about the same length, and placed at an acute angle with respect to

*LASTREA SPINULOSA.*

main rachis. The pinnae are pinnate, with detached
a distant pinnule of an oblong figure, more or less

deeply pinnatifid, some of the lower pinnules on the lower pinnae becoming almost pinnate. The lower pinnules are attached by their ~~narrowed~~ stalk-like base, which is slightly decurrent, becoming more and more decurrent towards the point of the pinna. Usually one or two of the inferior basal pinnules or the lowest pair of pinnae are markedly larger than the corresponding superior ones, giving these pinnae an obliquely lanceolate figure; sometimes the second pair of pinnae exhibit a similar discrepancy, though in a less degree; this difference in the size of the pinnules is not, however, equally marked in all cases. The pinnules are connected by a narrow wing. All the lobes of the pinnules are sharply toothed or serrated, the teeth ending in a short spinous mucro; "each serrature, with its accompanying spine, has a decided curve towards the apex of the pinnule." The midvein is sinuous, sending off lateral branches, one to each lobe of the pinnule; these lateral veins are more or less forked, one branch leading to each serrature, but terminating within the margin; the anterior branch bearing a sorus which is situated just within the sinus of the lobe—the sori thus forming a line on each side the midvein, and slightly distant from it. In the larger pinnules, which are divided almost down to the midvein, each lateral vein runs up the centre of a lobe, sending out another series of simple alternate lateral veins, several of which bear a sorus; these larger lobes thus become diminutive representations of the less divided pinnules. The sori are nearly circular, usually small and distinct, though often crowded, covered by a flat reniform persistent indusium, the margin of which is waved, quite entire, and without glands; the sori are sometimes confluent on plants growing in exposed situations. The fructification, usually confined to the upper portion of the fronds, is mature in August and September. The variety *crispa*, described by Dr. Deakin, is extremely rigid, and the margins of the lobes are curled under, so as to be with great difficulty unrolled; the sori are said to be larger, and of a darker colour.

This is no doubt a commonly distributed species throughout England, though, from its being confounded with *Lastrea dilatata*, the information respecting it is not trustworthy. In Wales it appears to be less common. Of its existence in Scotland and Ireland, there appears to be no

very certain information. It has, however, been found in other European countries. The habitats which it affects are marshy places and moist woods.

This is a free growing and easily cultivated species, and being of a distinct and rather remarkably erect habit, and bearing exposure well, it is very suitable for rock-work. It, however, grows well in any other situation suitable for ferns.

7. *Lastrea dilatata*, Presl (broad prickly-toothed, or Roth's Fern); fronds arched ovate-lanceolate or oblong-lanceolate bipinnate; pinnules pinnatifid or pinnate, with serrated spinose-mucronate lobes; indusium evanescent, the margin fringed with stalked glands; stipes clothed with entire lanceolate scales.—DESC : *Lastrea dilatata*, Presl: Bab. Manual, 2 ed. 411. *Lastrea multiflora*, Newm. Nat. Alm. Id. Brit. Ferns, 2 ed. 216. *Aspidium spinulosum*, Willd. Hook. Brit. Fl. 5 ed 440. *Aspidium dumosorum*, Sm. Eng. Fl. iv. 281. *Polypodium dilatatum*, Hoffm. (1795). *Polystichum multiflorum*, Roth (1797).—FIG: Eng. Bot. 1461. Newm. 215 (good).

α . *multiflora*; fronds ovate-lanceolate, semi erect; scales of the stem with a dark centre, and diaphanous margin.

β . *dilatata*; fronds almost triangular drooping dark green; scales of the stem as in α .—*Lastrea multiflora*, β . *dilatata*, Deakin. *Aspidium dilatatum*, Willdenow. Sm. Eng. Fl. iv. 280. Franc. Anal., 3 ed. 42.

γ . *maculata*; fronds oblong-ovate; scales of the stem of an uniform reddish-brown colour.—*Lastrea maculata*, Deakin Florigraph. Brit. iv. 110.

δ . *collina*; fronds narrow elongate-lanceolate; pinnæ very distinct; scales of the stem as in α .—*Lastrea multiflora var. collina*, Newman.

The broad prickly-toothed Fern has a large tufted caudex, with black wiry tenacious roots, and a densely scaly crown. The fronds, in favourable situations, reach the height of five feet, and a width of a foot and a half, varying from this stature down to one foot in height, according to situation: their position is curved, arched, or pendulous, never erect, as in *Lastrea spinulosa*. The vernation is peculiar, and is thus described by Newman:—"The main stem of the frond, instead of being regularly circinate, or composed



LASTREA DILATATA.

of diminished rings, like those of an Ionic volute, is doubled [laterally] near the insertion of the second pair of pinnae, and turns back, forming a kind of loop." In the young state the fronds are glandular, especially on the under side. The stipes is of moderate length, very stout at the base, and there thickly clothed with long pointed scales, which, in most of the varieties, are very dark coloured down the centre, and paler and nearly transparent at the margins. The fronds, in outline, are ovate-lanceolate, varying from almost triangular to almost lanceolate; and they are altogether larger than in *Lastrea spinulosa*; sometimes the fronds of young or starved plants are deltoid, but this is not the case with perfect ones; they are bi-pinnate, the pinnae in pairs, but not exactly opposite, and the pairs most distant from each other, on the lower part of the frond. The pinnae vary in form, the lowest being often nearly triangular, and shorter than the next three or four above, the others becoming gradually narrower, and almost linear; near the apex they are pinnate, the larger pinnules on the lower part of the frond being attached by a short slightly winged stalk, those towards the point of the pinnae, and in the upper part of the frond becoming gradually less distinctly stalked, and eventually decurrent. Some of the inferior basal pinnules, especially those of the lower pinnae, are much larger than the corresponding superior pinnules, giving these pinnae an oblique figure. The pinnules are variously divided, but are more or less convex; those at the base of the pinnae are almost pinnate, further up they are pinnatifid, and towards the apex they become more or less deeply toothed; all the lobes are sharply serrate, the teeth ending in a short spinous mucro. The veining is similar to that of *Lastrea spinulosa*, adapted to the more compound state of the present species. Each lateral vein which branches from the midvein of the pinnule, ramifies within one of the ulterior lobes, and is more or less divided, according as this is large or small. The sori are very numerous, and much scattered; on the more compound pinnules they are ranged in two lines, on each lobe, crosswise the pinnule, just within the toothed margins, but in the upper part of the frond, and also towards the apex of the pinnae, they range in two lines lengthways the pinnule, and near the midrib, in the way described under *Lastrea spinulosa*, but less regularly, or not so perfectly

two ranked. The sori are nearly circular, and are covered by an irregular reniform indusium, which is more or less fringed with glands. The fructification is mature in August and September, and is scattered over the whole under surface of the fronds.

The variety *maculata* grows with a stipes about as long as the frond, thickly clothed with lanceolate pointed scales, of a uniform brown colour. The frond is dark green, becoming spotted with irregular purplish blotches, and sprinkled on the lower surface with stalked glands. The three or four lowest pairs of pinnae are elongate-deltoid, and of nearly equal length, the rest lanceolate. The lateral veins of the lobes terminate in the acute spinous teeth along their margin, and each anterior branch bears a sorus immediately below the angle of the cleft which separates the lobes. It was found by Dr. Deakin on the top of Goatfell mountain, in the Isle of Arran. The variety *dilatata* is altogether remarkably convex, the fronds being arched, and every part more or less curved downwards. The pinnae are broadly lanceolate, the lower pair more deltoid than the rest, in consequence of the larger size of their lower pinnules. Starved plants of this form have been hesitatingly ranked as another variety by Newman, under the name of *nana*; they are smaller, much more rigid, and of a dark brownish green colour; the sori are large and distinct, having small, imperfectly developed, shapeless indusia, from which the glands, usual to the species, appear to be absent. This form is not at all uncommon. Mr. Newman's variety *collina* has the stipes half as long as the frond, and varies between deltoid and lanceolate in the figure of the frond, the latter being regarded as the mature, and the former the young state of the plant. The stipes is pale green, with dark brown scales, resembling in form and colour those of *Lastrea dilatata*. The pinnae are very distinct, and set on at nearly right angles with the main rachis, the first pair obtusely deltoid, the next pair elongate deltoid, and the rest narrowly lanceolate; the spines of the serratures are less distinct than in the allied forms. The sori are borne on all the pinnae, but least abundantly on the lower pair; they are crowded, and become confluent, hiding the midrib of the pinnales; the indusium does not offer any differences from that of the other forms of this species. This has been found on the hills of Yorkshire, Lancashire, and Westmoreland. Mr.

Newman thinks this latter may be the same plant as the *Polypodium tanacetifolium*, Hoffman, *Polystichum tanacetifolium*, De Candolle; and is inclined to regard it as a species distinct from *Lastrea dilatata*, for which he has suggested the scientific name *Lastrea collina*, and the English appellation of Pinder's fern, in compliment to Mr. Pinder, who first directed attention to its differential characters.

There is reason to believe that the forms of *Lastrea dilatata* are distributed almost universally throughout Great Britain, growing commonly in sheltered hedgebanks and moist woods, among vegetable earth, under which circumstances it attains its greatest degree of luxuriance. In more exposed situations it becomes smaller, and less luxuriant. It appears to be also common on the Continent of Europe and in North America.

Like the last, this species is of free growth, and easy culture, suitable either for rockwork, shady borders, or wilderness scenery. It is one of the most compound of our native species, and some of the forms are not inelegant. It succeeds better in the shade than when too much exposed, but may be grown fully exposed.

8. *Lastrea Fænisepii* Watson (triangular prickly-toothed, recurved, or Bree's Fern); fronds curved triangular bipinnate; pinnules pinnatifid or pinnate with serrated spinose-mucronate lobes; indusium jagged at the margin with minute sessile glands; stipes clothed with laciniate lanceolate concolorous scales.—DESC: *Lastrea Fænisepii*, Watson, Phytol ii. 568 (July, 1846). Bab. Manual, 2 ed. 411 (1847). *Lastrea recurva*, Newm. Nat. Alm. Id. Brit. Ferns, 2 ed. 226. *Nephrodium Fænisepii*, a., Lowe (1830). *Aspidium dilatum recurvum*, Bree (1831). Franz. Anal. 3 ed. 43. *Aspidium dilatum concavum*, Bab.—FIG: Newm. 225 (good).

The triangular prickly-toothed Fern has a large tufted caudex, with numerous roots. The fronds grow up in May, and are at first regularly convolute; in this undeveloped condition, the superior size of the lower pair of pinnae is remarkably manifest. They vary from one to two feet, or perhaps more, in height, and have, when fully developed, a graceful, curved, drooping habit, and a remarka-



LASTREA FENISECKII.

bly crisped appearance, caused by each of the lobes of the pinnules being concave, that is, the edges are curled upwards or backwards; they are covered with minute nearly globular sessile glands. The stipes is about as long as the frond, of a dark purple colour, and woody texture, and clothed with long, narrow, laciniate, pale-brown concolorous scales, of small size, and often so numerous as to give the stipes and rachis a shaggy appearance. The frond is bipinnate, and truly deltoid, or rather elongate-triangular, the lowest pair of pinnae being much larger and longer than the rest, the others becoming gradually smaller to the apex; the lowest pair of pinnae is distinctly stalked. The pinnae are pinnate, the pinnules towards the base of the pinnae are distinctly stalked, but they become decurrent towards the apex. The first inferior pinnule on two or three of the lowest pinnae is considerably enlarged, and the basal inferior pinnules are generally larger than the superior ones, becoming smaller and shorter towards the apex; the first four or five pairs of pinnae have thus a triangular outline, the lowest broadest; the first basal inferior pinnule is larger on the lowest pinnae, than on those above. The principal lower pinnules are completely divided into numerous oblong lobes, which are chiefly decurrent, but one or two of the lowest often slightly stalked; the largest of these lobes is often again divided almost to their mid-vein; the upper pinnules are more or less deeply lobed, or toothed; all the lobes are sharply serrated, the teeth ending in a short spinous mucro. In the veining and distribution of the sori, this plant is similar to *Lastrea dilatata*, but the present is usually more compound, the lobes of the pinnules being more distinct, and having each a more perfect biserial arrangement of sori; the smaller pinnules in this, as in *Lastrea dilatata*, bear only two lines of sori, one on each side their midvein. The sori are abundantly and pretty equally distributed over the whole under surface of the frond; and have a small reniform indusium, which is usually jagged and uneven on the margin, with minute globular sessile glands. The fructification is mature in August and September.

What appears to be a very elegant form of this species, exists in the Herbarium of the Botanical Society of London ("Clune cascade, Kerry, W. Andrews"). The leafy portion of this frond is about a foot and a half in length;

The lower pinnae are eight or nine inches long, and distinctly alternate; the pinnules slender, distant, elongated, with narrow, distant, markedly decurrent lobes. The whole frond has a remarkably narrowed and elegant aspect, which may probably be owing to the situation in which it has grown—favourable to the elongation of its parts.

This species is not unfrequent in the southern and northern counties of England; it is also stated to have been observed in Scotland. In Ireland it is very abundant. It occurs both in warm sheltered woods, and in exposed rocky places, amongst grass or other herbage.

The spinulose group of ferns, including *Lastrea spinulosa*, *dilatata*, and *Fœniculæ*, is one, the cultivation of which is attended with no peculiar difficulties. Each of them, and especially the two last, grow best in shady situations, but they may also be grown under any degree of exposure, though in that case they do not attain great luxuriance. They are perfectly hardy, and grow in any common loamy soil. If potted, they should be sheltered in winter by plunging the pots in ashes, sawdust, or old tan, in any convenient situation.

GENUS V.

POLYSTICHUM.

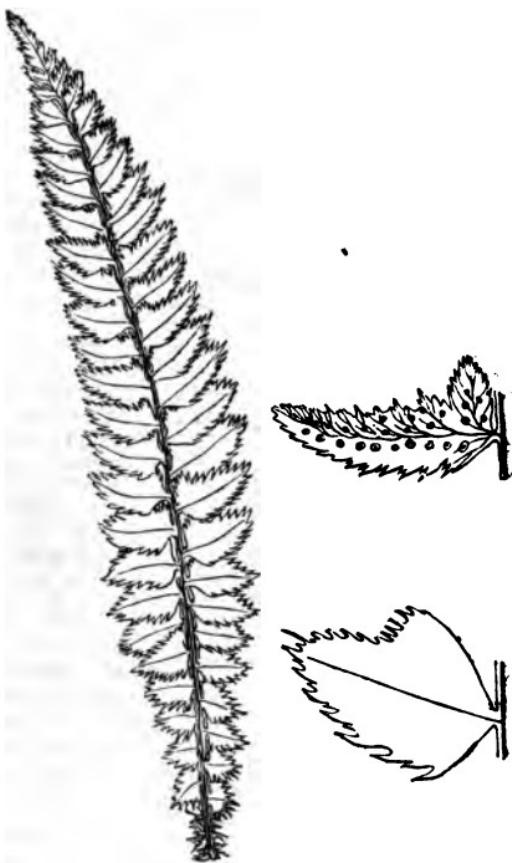
POLYSTICHUM, *Roth*.—Midvein distinct, lateral veins branched free; sori nearly circular indusiate attached at the back of the lateral veins: indusium circular attached by its centre.—Name derived from the Greek *poly* (many) and *stichos* (order) in allusion to the numerous regular lines in which the sori are disposed.

This genus embraces a series of British forms, the extremes of which are very different in their appearance, but they are so closely connected by intermediate forms as to render it a matter of much doubt and difficulty which among them, or how many of them, are with propriety to be regarded as distinct. This difficulty I am unable to remove, nor is it likely to be removed until some more definite and settled notions as to what really constitutes a species or a specific difference, gain general acceptance. The almost unbroken series commencing with the blunt, rigid *Lonchitis*, through the narrower elongated form of *Lonchitis*, the scarcely divided rigid *lonchitoides*, the narrower pinnate-pinnatifid rigid *lobatum*, and the broader twice-pinnate less rigid *aculeatum*, up to the most delicately textured and compound *angulare*, seem to forbid the breaking up of the group; and yet *Lonchitis* and *angulare* are so unlike as to forbid their combination. Under these circumstances I have adopted a middle course, retaining the two extremes as species, and the intermediate forms as

varieties of a third species, though without being at all satisfied that these are natural divisions. The difficulties in which questions of this nature are themselves involved, are, in this case, much increased by the confusion which prevails in respect to the application of specific names. On this question, Mr J. Smith, one of our best pteridologists, has remarked:—“Writers on British ferns differ much in opinion as to the specific distinctions between what is called *Polystichum aculeatum*, and *P. lobatum*; but a much wider field is open for this kind of controversy if they would but take a general view of the whole series of ferns constituting this group of *Aspidiaceæ*, representatives of which are found widely dispersed over the earth, being found in elevated regions within the tropics and extending into the higher latitudes of both hemispheres. As might be expected, these different localities produce forms more or less differing from each other, the extremes presenting characters sufficiently well marked to be considered as of specific value; but on taking a comprehensive view of the whole group, a transition of form is readily traced, constituting such a series that it becomes most difficult to say what is a species, and what may be only a variety dependent on the nature of the locality; and although in many instances we see something in the habit and aspect sensibly different from another form, yet words fail to convey to our minds the distinction.”

Analysis of the Species.

Fronds pinnate	1. <i>P. Lonchitis</i>
Fronds bipinnate	
pinnules acute-angled or wedge-shaped at the base, attached by the apex of wedge, or decurrent	2. <i>P. aculeatum</i>
pinnules obtuse-angled at the base, attached by a distinct slender stalk	3. <i>P. angulare</i>



POLYSTICHUM LONCHITIS.

1. *Polystichum Lonchitis*, Roth (rough alpine or Holly Fern); fronds linear-lanceolate rigid pinnate: pinnae not lobed serrate spiny auricled at the base above and oblique below.—DESC: *Polystichum Lonchitis*, Roth.

Newm. Brit. Ferns, 2 ed. 163. Bab. Manual, 2 ed 411.
Aspidium Lonchitis, Swartz. Eng. Fl. iv. 271. Hook.
Brit. Fl., 5 ed. 438. Franc. Anal., 3 ed. 32. *Polyopodium Lonchitis*, Linn.—FIG: Eng. Bot. 797. Newm.
163. Franc. pl. 2. fig 4.

The rough alpine Fern has a tufted scaly *caudex*, from which strong black wiry roots are produced. The fronds are more or less persistent, the young ones appearing early in spring, arriving at maturity in the autumn, and remaining in full vigour through the winter onwards. They are from six to eighteen inches in height, linear lanceolate in outline, rigid and leathery in texture, usually somewhat erect though sometimes lax and drooping in habit, of a harsh deep green colour, and prickly like a spike of little holly leaves. The stipes is very short, clothed below the leafy part with large broad taper-pointed chaffy scales, above with smaller ones. The fronds are pinnate; the pinnae short crowded alternate, simple, extending nearly to the base of the stipes; they are somewhat crescent-shaped, the base being auricled on the upper side, and sloped or cut away on the lower side, the margin being serrated and acutely spined. The pinnae are twisted, so that the auricled portion of each passes behind the pinna next above it, and projects behind "almost at right angles with the stem;" this character is most observable in Irish specimens. The mid-vein is distinct with free alternate lateral branches; these lateral veins are generally three-branched, the anterior branch bearing a sorus about half-way between the mid-vein and margin, and usually (?) terminating just beyond it; the other branch becomes forked, its branches reaching the margin. The veins of the enlarged lobes at the base of the pinnae are more compoundly branched. The sori form a line on each side the mid-rib often crowded and sometimes confluent; they are each covered by a circular indusium, which is peltate or attached to the vein by a short central stalk. The fructification, which is mature in September and October, is usually confined to the upper part of the fronds.

This rare northern species, of distinct and elegant habit, is found in the fissures of rocks towards the summits of some of our loftiest and bleakest mountains, exposed to storms and blasts, to meet which its constitution seems to

be specially adapted. Mr. Simpson informs me that in the crevices of the high rocks on Falcon Clints it produces but few fertile fronds, but that at Maze Beck Scar, close by, where the plants, though rare, are nearer the water, the fronds are principally fertile. It is met with rarely both in England, in Wales, and in Ireland, and more abundantly in Scotland, and is found in other parts of Europe.

Polystichum Lonchitis is a plant of very tardy increase; the same crown may be cultivated for years without throwing out any offsets for the purpose of propagation. It may be kept in good health if potted *firmly* in a soil of sandy loam, which should be tolerably well drained. The best situation in which to keep it, is a cool moist frame, in which it will grow with tolerable vigour. Fully exposed on rockwork, it will rarely be found to have a prolonged existence, unless the circumstances of its natural localities can be tolerably simulated.

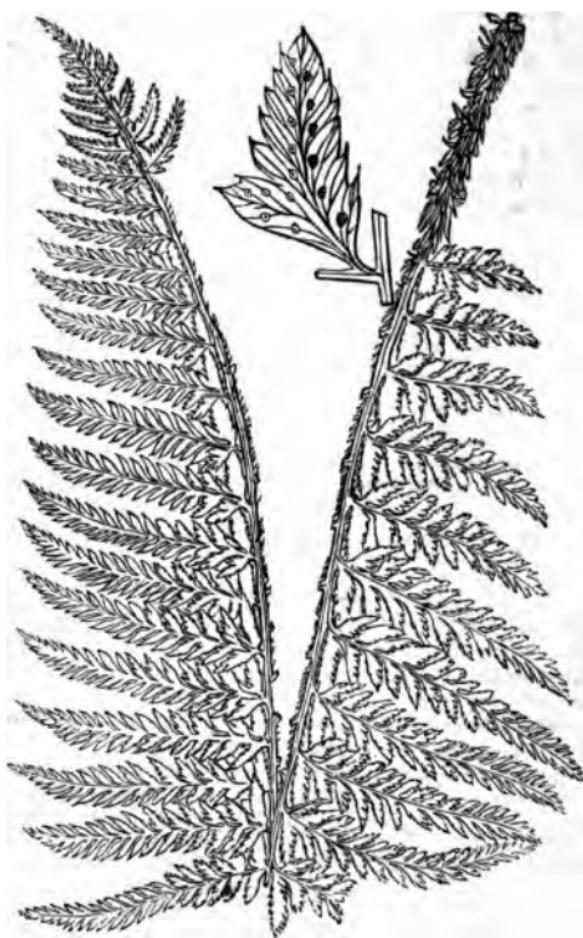
2. *Polystichum aculeatum*, Roth (common prickly Fern); fronds linear-lanceolate or lanceolate rigid bipinnate: pinnules obliquely decurrent acute, that next rachis on the upper side largest, all more or less prickly-serrate.

—DESC: *Polystichum aculeatum*, Roth, Newm. Brit. Ferns, 2 ed. 169. Bab. Manual, 2 ed. 411. *Aspidium aculeatum*, Swartz. Sm. Eng. Fl. iv. 277. Hook. Brit. Fl. 5 ed. 438. *Aspidium lobatum*, Swartz. Sm. Eng. Fl. iv. 278. Hook. Brit. Fl. 5 ed. 438. Franc. Anal., 3 ed. 33. *Polypodium aculeatum*, Linn. *Polypodium lobatum*, Huds.—FIG: Eng. Bot. 1562. Newm, 169. Franc. pl. 2, fig. 5.

β. lobatum, fronds narrow-lanceolate, very rigid, pinnules convex, the margins prickly-serrate.

γ. lonchitidoides, fronds pinnate or sub-bipinnate, the pinnules being combined (*Filix lonchitidi affinis*, Ray).

The common prickly Fern, is, as Newman well observes, of protean character, serving as it does to unite by a series of intermediate links, the nearly simple *Lonchitis*, with the highly compound *P. Polystichum angulare*. It has a large tufted caudex, which is very enduring, and in age acquires a woody character; from it are produced the numerous strong coarse roots. The fronds are persistent, retaining their verdure through the winter, and their form for three



POLYSTICHUM ACULEATUM.

or four years; the young ones grow up about April, and are full grown by about the middle of the summer, the fructification being mature about September. The vernation, both of the frond and pinnae is circinate, and when about half developed, the apex of the fronds is also curved backwards in a very elegant manner. They usually vary from one to two feet in height, and are of a lanceolate figure, (narrow lanceolate in lobatum), and tough, rigid, and leathery in texture, so that the fronds droop but slightly. It is, however, an elegant species, the rachis often assuming a lateral curve,



Polystichum lobatum, vars.

and the upper surface of the frond being more or less shining. The stipes is usually short, and densely scaly, the scales being chiefly of a rusty reddish colour, large at the base of the stipes, and becoming smaller upwards. The fronds are bipinnate, the pinnae being alternate, and found in various states of division, sometimes almost entire (when it is called lonchitidoides), sometimes with one or two lobes at the base, sometimes with a few decurrent pinnules at the base (when it is lobatum), and sometimes pinnate, as far as or beyond the middle; in the latter case moreover the pinnules are either attached to the midrib in a markedly decurrent manner, or else they appear less decurrent and more distinctly stalked, when it approaches *Polystichum angulare*, and is then indeed not easily defined. In the most distinctly stalked examples which I have seen of *Polystichum aculeatum* the base of the pinnule was decidedly

wedge-shaped, gradually narrowing from its widest diameter at the articulated part, down to its attachment with the midrib; the base of the pinnule thus forms an acute angle, the point of which touches the midrib of the pinna; the attachment of the stalk-like base of the pinnule with the midrib of the pinna, also describes an acute angle. Both the form of the base of the pinnule, and the position in which it becomes attached to the midrib of the pinna, in *Polystichum angulare* appear to differ from this, and to present the best means of distinguishing the two plants in their nearly allied states. There is no difficulty in distinguishing them, as *Polystichum aculeatum* recedes from this point, the decidedly decurrent pinnules becoming then a safe and obvious diagnostic. The pinnae are narrow-lanceolate; the pinnules somewhat crescent shaped, acute and aristate at the apex, and fringed with spiny-serratures on the margin. On each pinna the basal upper pinnule is larger and longer than the rest, the side next the main rachis is usually straight, forming a line parallel with it, and its apex usually points directly towards the apex of the frond; there is thus a row of these enlarged pinnules on each side the main rachis. All the pinnules are more or less convex; they are moreover, especially the enlarged one, distinctly auricled at their base on the outer side, the auricles being sharply awned. The venation is similar to that described under *Polystichum Lonchitis*, differing only in the lateral veins being rather more branched in accordance with the more or less compound division of the plant. The semi form two lines parallel with the midvein of the pinnules, and also of their auricles; they are often crowded, and sometimes confluent, each covered by a circular indusium, attached by its centre, the vein extending beyond it nearly to the margin. The fructification is mature in September and October.

This species is common in hedge banks, and similar situations throughout the United Kingdom—least so in Iceland. It is moreover abundant almost all over Europe, and is found in Asia, Africa, and North America.

In cultivation, this is a free growing plant, associating well with its near ally *Polystichum angulare*. Both of them will grow in exposed situations, but attain their highest perfection when growing in the shade.

3. *Polystichum angulare*, Newman (angular lobed or Willdenow's Fern); fronds lanceolate lax drooping bipin-

note: pinnae truncate below distinctly stalked bluntnish
prickly-serrate.—Disc: *Polystichum angulare*, Newm.



POLYSTICHUM ANGULARE.

Brit. Ferns, 2 ed. 173. Bab. Manual, 2 ed. 412. *Aspidium angulare*, Willdenow. Sm. Eng. Fl. iv. 278. Hook. Brit. Fl. 5 ed. 438.—FIG : Newm. 173. Eng. Bot. Supp. 2776.



Polystichum angulare, vars.

β. subtripinnatum, lower pinnules deeply pinnatifid, the basal lobes almost stalked.

γ. angustatum, pinnules small, narrow, and acute.

The angular-lobed Fern forms a large tufted caudex, which becomes woody in age, throwing out numerous branches, so that an old plant often forms a tuft of several

crowns all attached to the same base; from this stem the strong, coarse, numerous roots are protruded. The fronds are persistent, and remarkably elegant; they retain their verdure throughout the winter, and the old undecayed fronds of preceding years, though dead and entirely discoloured, are usually found about the bases of the plants, in which respect it closely resembles *Polyst. aculeatum*. The whole plant is softer, more delicate in texture, and more shaggy than in that species. The stipes is usually elongated to about one-fourth, or sometimes one-third the length of the frond, and is densely clothed with coarse reddish-coloured chaffy scales, which also cover both the main and secondary rachis, the scales becoming smaller upwards, and at length almost capillary. The fronds are lanceolate, usually from two to three feet, but sometimes four or five feet high, "weak, flexible, graceful, and drooping;" the outline of the whole frond is generally rather broader than in *Polystichum aculeatum*. A strong aged crown frequently produces as many as thirty or more fronds, which, under any circumstances, from the laxity of their habit, assume a beautiful and graceful attitude. The fronds are bipinnate. The pinnae are numerous, elongate, tapering, distinct, and often distant. The pinnules are flat, somewhat crescent shaped, and bluntnish, distinctly and often deeply serrated on the margins, the serratures being spinulose; at the base they are truncate, and auricled on the upper side, and somewhat rounded on the lower side; they are obtuse angled, and attached to the midrib of the pinnae by a distinct slender stalk. The basal superior pinnule on each pinna is usually scarcely larger than the others; it is in most cases more deeply serrated than the rest, and sometimes both it and others on the lower part of the pinnae are deeply pinnatifid, or even partially pinnated (when it forms the variety *subtripinnatum*). Various degrees of this condition are, however, met with not unfrequently. The base of the pinnules in *Polystichum angulare*, instead of forming an acute angle, as described under *Polystichum aculeatum*, forms, in fact, a very obtuse angle, the point of the angle being not attached to the midrib of the pinnae, as in that plant, but connected therewith by a short and slender but distinct stalk, which again is attached to the midrib at a much more obtuse angle than in the case of the pinnules of *Polystichum aculeatum*. The variety

angustatum is a very graceful plant, the parts being narrower and more acute than in the other forms, and the pinnules seated on somewhat longer pedicles. Scattered on the under surface of the pinnules are often some fine hair-like scales. I do not find anything peculiar in the mode of venation. The lateral veins of each pinnule are branched, the anterior branch bearing a sorus, and scarcely continued beyond it; the other branch extends to the margin, and is sometimes simple, and sometimes forked; the lobe at the base of the pinnule has a vein through its centre, throwing off simple branches, some of which bear sori. The sori are numerous, often crowded, sometimes confluent; they are furnished with nearly circular indusia, depressed in the centre, at which part they are also attached to the veins, thus being peltate. The copious fructification is mature in September and October.

This species (not uncommonly known among British botanists as *Polystichum aculeatum*), appears to be abundantly distributed throughout England, as far north as Yorkshire. It is also met with in Wales, and abundantly in some parts of Ireland. It appears to be uncommon in Scotland, if indeed it is at all met with there, which Sir W. Hooker seems to doubt. It prefers lowland sheltered woods and hedge banks, where the soil is moist, and in such situations grows with much luxuriance.

It is a very manageable plant, growing freely in any light soil. In moist sandy banks, it attains great vigour, as it does also in woods where the soil is principally composed of decayed leaves. For rock-work, it is one of the most ornamental of all our hardy species, and its persistent evergreen habit is, in such a place, a great additional recommendation. It should be planted in a light soil, and in a shady situation. In wilderness scenery, too, it would be at home, and no plant would be more appropriate or effective in such situations. It is easily cultivated in pots, requiring, however, a considerable share of pot-room, and a cool shady situation.

GENUS VI.

CYSTOPTERIS.

Cystopteris, Bernhardi.—Mid-vein distinct, sinuous lateral veins branched free; sori roundish, indusiate, attached to back of lateral veins; indusium hooded or cucullate, fixed by its broad base beneath the sori, which it covers when young, becoming reflected; its apex fringed, and directed towards the apex of the segment.—Name derived from the Greek *kystos*, (a bladder), and *pteris* (a fern), in allusion to the peculiar form of the indusium.

The Bladder ferns are all very elegant plants, with much divided fronds, of delicate texture. Some difference of opinion obtains in respect to specific limits in this, as in some other of the genera of British ferns; the different forms being regarded as distinct species by some, while by others they are allowed only the rank of varieties. Undoubtedly a very closely connected series may be traced under the names *fragilis* *angustata* and *dentata*. I have no hesitation in considering these as different forms of the same species. *Cystopteris alpina* is probably distinct, as also no doubt is *Cystopteris montana*.

Analysis of the Species.

Fronds lanceolate

ipinnate, pinnules variously
 out, the segments more or

 less acute, 1. *C. fragilis*.

 sub-tripinnate, pinnules con-
 fluent, the segments linear-

 obtuse, 2. *C. alpina*.

Fronds deltoid, three-branched, 3. *C. montana*.



CYSTOPTERIS FRAGILIS.

1. *Cystopteris fragilis*, Bernhardi (brittle Bladderfern); fronds lanceolate bipinnate: pinnæ ovate-lanceolate, or oblong-lanceolate; pinnules ovate, or ovate-lanceolate pinnatifid or toothed.—DESC : Hook. Sp. Fil. i. 197. Bab. Manual, 2 ed. 412. Newm. Brit. Ferns, 2 ed. 149 (excl. var. *alpina*). The forms enumerated below are distinguishable, though closely connected by intermediate states :—

- α. *Dickieana*, fronds ovate-lanceolate; pinnæ crowded, overlapping; pinnules crowded, broad obtuse, very slightly toothed; sori marginal distinct.—DESC : *Cystopteris Dickieana*, Sim. in Gard. Jour. (1848) 308. I am indebted to Dr. Dickie for specimens of this distinct variety, found by him on rocks near the sea at Aberdeen. The overlapping pinnæ are twisted in the same way as those of *Polystichum Lonchitis*, giving it a very distinct appearance, which it retains under cultivation. It is the least divided British form of *Cystopteris*.
- β. *dentata*, fronds oblong-lanceolate; “pinnules ovate-obtuse, bluntly toothed or rarely pinnatifid;” sori marginal, often crowded, sometimes confluent—DESC : *Cystopteris dentata*, Hooker, Brit. Fl. 5 ed. 441. Franc. Anal. 3 ed. 28. *Cyathea dentata*, Sm. Fl. Brit. 1141. *Cystea dentata*, Sm. Eng. Fl. iv. 287. *Polypodium dentatum*, Dickson. *Aspidium dentatum*, Swartz.—FIG. Eng. Bot. 1588. Newm. 154. Franc. pl. 2, fig. 1.
- γ. *vulgaris*, fronds lanceolate; “pinnules ovate-acute pinnatifid, cut, or serrated;” sori becoming confluent, more central than in β.—DESC : Hook. Sp. Fil. i. 197. *Cystopteris fragilis*, Bernhardi. Hook. Brit. Fl. 5 ed. 441. Franc. Anal. 3 ed. 29. *Cyathea fragilis*, Sm. Fl. Brit. 1139. *Cyathea cynapifolia*, Roth. *Cyathea anthriscifolia*, Roth. *Cystea fragilis*, Sm. Eng. Fl. iv. 285. *Polypodium fragile*, Linnæus. *Polypodium cynapifolium*, Hoffman. *Polypodium anthriscifolium*,



Cystopteris fragilis, var. Dickieana.

Hoffm.—FIG. Eng. Bot. Supp. 2790. Eng. Bot. small ed. 1427. Newm. 155. Franc. pl. 2. fig. 2.

3. *angustata*, fronds oblong-ovate; “ pinnules linear-lanceolate, deeply and acutely pinnatifid, or slightly

toothed on the margin; ultimate subdivisions oblong or linear, not dilated, rounded or ovate, sometimes notched at the end;" sori distinct, scattered.—DESC : *Cystea angustata*, Sm. Eng. Fl. iv. 288. *Cystopteris dentata*, S., Hook. Brit. Fl. 5 ed. 441. *Cystopteris fragilis*, S., Franc. Anal 3 ed. 30. *Cyathea fragilis*, S. and y. Sm. Fl. Brit. 1139. *Polypodium rhaticum*, Dickson. *Acydium rhaticum*, Willd.—FIG : Newm. 156.



Cystopteris fragilis, vars.

The brittle Bladder-fern is an exceedingly variable plant, assuming several tolerably distinct forms, as already explained; but these are so closely connected by intermediate states, as hardly to admit of definition. Indeed, fronds approaching either form may, in some cases, be obtained from the same root at different periods, and under varying circumstances. This species has a tufted caudex, producing numerous wiry roots. The fronds are very delicate in every state, springing up early in the spring, and dying down annually; they soon arrive at maturity, and as speedily decline, a succession of fronds being produced throughout the summer and autumn, disappearing altogether with the first frosts of winter. The general form is lanceolate, varying from oblong-lanceolate to oblong-ovate; the size is also very variable—from three or four to twelve or fifteen inches in height. In the variety *Dickieana*, the average height is four to six inches; in *dentata*, from six to eight inches; in *vulgaris*, they vary from four inches to a foot, or more; and in *angustata*, from six to fifteen inches high;

they grow up several together, more or less erect. The stipes is smooth, of a brown or blackish colour, very brittle and juicy, occupying from about one-third to one-half the height of the frond, destitute of scales, excepting a few small ones at the base; in the upper part it is usually slightly bordered or winged (except in *angustata*, which Smith describes as being "without a membranous border"). The fronds are bipinnate, or scarcely so, in Dr. Dickie's variety, in which the pinnae and upper pinnules are often confluent. The pinnae in *Dickieana* and *dentata* are ovate-lanceolate; in the former, they are somewhat twisted round, so that one edge points backwards, and the other forwards, and in the young fronds of the latter, they are "reflexed drooping convex;" in *vulgaris*, they are more lanceolate, with the pinnules more distinct; and in *angustata* they are ovate-lanceolate and taper-pointed. The pinnules in *Dickieana* are mostly somewhat decurrent, and sometimes much so, broad, obtuse, having but a few shallow notches on the margin; in *dentata*, they are ovate, obtuse, pointless, deeply and bluntly toothed, or, in luxuriant specimens, a few of the lowest pinnatifid; in *vulgaris*, they are ovate, acute, or pointed, tapering at the base, and copiously, deeply, and sharply toothed on the margin, the larger and lower ones deeply pinnatifid, their lobes resembling the upper pinnae; in *angustata*, they are linear lanceolate decurved, deeply and acutely pinnatifid, or slightly toothed at the margin, the ultimate divisions being always oblong or linear, never dilated, rounded, or ovate, sometimes, though seldom, notched or cloven at the end. In all, the texture is delicate (in *angustata* and *Dickieana* most especially so, and least so in *vulgaris*); from this cause, the venation is very distinctly seen. The mid-vein of each pinnule is more or less sinuous or flexuose; from this the lateral veins are produced alternately becoming more or less branched, according to their position: in the larger lobes, where the lateral vein becomes a secondary midvein, a series of simple branches are usually produced, each extending to the margin, and generally bearing a sorus towards its extremity; in the smaller lobes the lateral veins become two, three, or four-branched, one branch extending to each of the serratures of the lobe. The sori are usually numerous, a sorus being borne by most of the veins; in *Dickieana*, they are less numerous, and ranged close to the margin,

often just within the sinus of the shallow lobes; in *dentata* they are also nearly marginal, but frequently more numerous; in *vulgaris* they are more central, the under surface being often covered as they become confluent; in *angustata* they are smaller and less prominent, and always continue distinct, standing either solitary, or in pairs, towards the bottom of each lobe or tooth. The sori are nearly circular, covered by a membranous pale concave or hood-shaped indusium, which is attached by its broad base beneath the capsules on the side towards the base of the lobe, the other extremity, or that towards the apex of the lobe, becoming free, and at this part split, jagged, or torn into narrow, unequal, often capillary segments; this indusium soon becomes reflected, and is at length obliterated, or pushed off by the growing spore cases. The fructification becomes mature by the month of July, or earlier.

The species is moderately abundant, and widely distributed throughout the United Kingdom, growing in the fissures of rocks and walls, in moist and mountainous districts, showing a preference for the limestone, and generally finest in the vicinity of waterfalls. Mr. Simpson who informs me that the variety *vulgaris* is met with on nearly all the bridges in the upper parts of the vales of the Tees, Yore, and Swale, and on many of the rocks in the same neighbourhood, but most luxuriant among the lime of the bridges, writes:—"On Egglestone Abbey Bridge, near Barnard Castle, the fronds are splendid—10 to 12 inches in length. This, I judge to be caused by the mist arising from the river, it being hemmed in here by the rocks of grey marble, over which it has dashed with tremendous force for half a mile, into a gulf just beneath the bridge. The best specimens I could not reach, my only assistance being the tongs of the old man at the toll-bar, and there was no chance of getting them from the river eighty feet below. The bridge has only been built about forty years; therefore the lime must be comparatively fresh." In Wales the variety *dentata* is the most abundant; and *vulgaris* in Scotland. Throughout the Highlands of Scotland this is very common, exhibiting a constant preference for walls and bridges: in the lowlands it is comparatively of rare occurrence. In Ireland the species is more rare. Mr. Newman found one of the varieties however in great profusion near the town of Sligo, occurring not only on the limestone rocks.

and walls, but also in the hedge rows, mingled with *Scolopendrium vulgare*; and Mr. Mackay states that it occurs in the southern, northern, and western counties. The same species—or what is considered to be such—is generally distributed throughout Europe, and in Asia, Africa, and North America, as well as the Islands of the Pacific.

From the delicate texture of this fern, and its adaptability to various situations, it is well suited for cultivation. Planted either on rockwork or in pots, and placed either within a frame or without one in a sheltered and shady position, it grows with vigour, though it becomes most beautiful when developed in the damp close atmosphere of a frame or glazed case. The small size of the plant renders it a more convenient object for pot culture than many other kinds, as a large tuft may be grown in a five-inch pot. It should be potted in a turf compost formed of loam, peat, and sand, well intermixed with potsherds or small lumps of broken charcoal, and a similar compost may be employed when it is planted out on rockwork. The other species of *Cystopteris* are similar in habit, and may be cultivated in the same manner. The dormant crowns should not be kept too damp during the winter. They all propagate readily by separating the crowns whenever more than one is formed; most of them form new crowns rapidly.

2. *Cystopteris alpina*, Desvaux (Alpine Bladder-fern); fronds lanceolate sub-tripinnate; pinnae ovate: pinnules ovate-oblong confluent deeply pinnatifid with broadly and shortly linear lobes having two or three erect blunt teeth.—Desv. : *Cystopteris alpina*, Desvaux. Hook. Sp. Fil. i. 199. Bab. Manual, 3 ed, 412. *Cystopteris regia*, Presl. *Cystopteris fragilis*, & Newm. Brit. Ferns, 2 ed. 157. *Cystopteris alpina*, Hook. Brit. Fl. 5 ed. 441. Franc. Anal. 3 ed. 30. *Cyathea regia*, Forster. *Cyathea incisa*, Sm. Eng. Bot. 163. *Cystea regia*, Sm. Eng. Fl. iv. 289. *Polypodium alpinum*, Jacquin. *Polypodium regium*, Linnaeus. *Polypodium trifidum*, Withering. *Aspidium regium*, Swartz.—Fig: Eng. Bot. 163. Franc. pl. 2. fig. 3. Newm. 157 (not good).

The Alpine Bladder-fern is an extremely elegant little plant, obviously different from all the forms of *Cystopteris fragilis*, but not easily distinguishable in words. The fronds,



CYSTOPTERIS ALPINA.

however, though more deeply divided than in that species, have their pinnules and segments much more closely and compactly arranged. It has a short tufted caudex, from which the fibrous roots are protruded. The fronds are numerous, erect, of a bright green colour, and elegant appearance, varying from four to eight or ten inches in height. They are usually produced in May and die down towards the end of summer. They are lanceolate in outline, bipinnated, the pinnae being very deeply pinnatifid, so as to appear almost again pinnate; they are not, however, truly tripinnate, the lobes of the pinnules being, I believe, in al-

most all cases, decurrent. The stipes is usually short, less brittle than in *fragilis*, and smooth except immediately at the base, where it is surrounded by a few pointed brown scales. The pinnae are ovate, divided into bluntly-ovate pinnules which are distinctly stalked. These latter are deeply cleft, almost down to the mid-vein, into short blunt linear lobes, which are sometimes entire, and sometimes have two or three erect blunt teeth; these lobes are distinctly decurrent at the base, so that the pinnules are pinnatifid, and not pinnate, although sometimes nearly so. The venation is very distinct: the mid-vein of the pinnae, which forms the secondary rachis, is slightly winged; the mid-vein of the pinnules is much less flexuous or zig-zag than in *fragilis*, being almost straight; from this a lateral vein branches off to each lobe, and these lateral veins are either simply forked or alternately three or four branched, according to the size of the pinnule, one branch extending to the point of each marginal tooth. The sori are borne towards the margin, and are rather numerous but not crowded, and I believe never confluent; they are small and roundish, with a white membranous concave indusium attached by its base towards the base of the lobes, having a free more or less jagged point. The fructification is mature in July.

This species has but slight claims to be regarded as a true native. The only authenticated habitat for it is on a wall at Low Layton, in Essex, where it was near the close of the last century, originally found in great plenty by Mr. T. F. Forster. The wall has, however, since then been repaired, and the plant is nearly eradicated, though it may still be found there and in the neighbourhood sparingly. I am indebted to the Botanical Society of London for the use of a specimen from that locality gathered in 1840 by Mr. E. H. Bulton. One or two Scotch and Welsh alpine habitats which have been assigned to this plant probably belong to some of the small much-divided forms of *fragilis*. The plant is distributed over the Alps of Europe, chiefly in the south.

It may be cultivated precisely in the same manner as *Cystopteris fragilis*.

3. *Cystopteris montana*, Link (mountain Bladder-fern, or Wilson's fern); fronds triangular tripinnate; pinnae spreading; ultimate pinnules narrow oblong or obtusely

sub-falcate inciso-dentate or pinnatifid, the lobes toothed at the apex.—DESC : *Cystopteris montana*, Link. Hook. Sp. Fil. i. 200. Newm. Brit. Ferns, 2 ed. 159. Bab. Manual, 2 ed. 412. *Polypodium montanum*, Allioni. *Cyathea montana*, Roth. *Aspidium montanum*, Swartz.—FIG : Newm. 159.



CYSTOPTERIS MONTANA.

The mountain Bladder-fern is well distinguished by its long stipes and small triangular fronds, which in shape resemble those of *Polypodium calcareum*. It has a long creeping filiform scaly caudex. The stipes is long, slender, erect, red-brown, slightly scaly near the base. The frond is triangular, tripinnate in the pinnules of the lower pinnae, bipinnate in the rest of the frond; the pinnae and pinnules are spreading. The first pair of pinnae are nearly opposite,

and very much larger than any of the others, often nearly equaling in size all the rest; the second pair of pinnae are nearly opposite, but the remainder gradually become alternate. The first inferior pinnule of the lower pair is very much larger and more divided than the first superior pinnule of the same pair; this disproportion decreases gradually, until, near the apex of the pinnae, the opposite pinnales nearly correspond in size. The pinnae are pinnate, the pinnales also pinnate, the lobes deeply pinnatifid and their divisions also notched: it is therefore one of the most compound of our ferns. The lateral veins of the ultimate divisions are alternate; each generally ceases in a sinus between two serratures. The sori are nearly circular, numerous, and becoming very prominent when mature; although crowded each appears to retain its individuality, never seeming to become perfectly confluent. The indusium is sub-round and very obtuse, attached at the back of each lateral vein, and bending forward in the manner of a hood opening towards the point of the serrature, its free margin jagged or uneven.—(*Hooker and Newman.*)

Only a single station for this plant has yet been found in Britain—on Ben Lawers, one of the Breadalbane mountains in Scotland, by Mr. Wilson, in company with Professors Hooker and Graham, in August, 1836. Mr. Wilson thinks it not probable it could have been introduced by accident, much less by design: all the specimens found were barren. Not being at that time known the plant was preserved unnamed until Mr. Wilson saw *Aspidium montanum* in the collection of Mongeot and Nestler, and was struck with the resemblance between that and the Scotch specimens. The species is met with in the Alps of Europe, most frequent in the north, and in the Rocky mountains of North America; “it is generally described as occurring on rough stony ground, sometimes in woods, and in sub-alpine regions.”

This is a strictly Alpine plant, and requires treatment similar to that recommended for the other species.

GENUS VII.

A T H Y R I U M.

ATHYRIUM, *Roth*.—Mid-vein distinct, lateral veins branched free; sori semi-lunate indusiate placed on the side of the lateral veins; indusium oblong-reniform opening longitudinally towards the mid-vein, the free margin fringed with capillary segments.—Name derived from the Greek *athyros* (opened) in allusion to the mode of dehiscence of the indusium, which at length becomes elevated along one of its margins, opening like a door, so as not to enclose the spore cases.

This genus was constituted by Roth, for the reception of our indigenous Lady Fern, which, from “the exquisite grace of its habit, the elegance of its cutting, and the brilliant delicacy of its colour,” claims precedence in beauty over every other British species. Roth’s genus is not universally adopted, the species being by some still retained under *Asplenium*.

1. *Athyrium Filix-femina*, Roth (Lady Fern); fronds lanceolate bipinnate: pinnae linear-lanceolate; pinnules linear-oblong, deeply serrate or pinnatifid.—Desc: *Athyrium Filix femina*, Roth. Newm. Brit. Ferns, 2 ed. 237. Bab. Manual 2 ed. 413. *Asplenium Filix femina*, Bernhardi. Hook. Brit. Fl., 5 ed. 443. Franc. Anal. 3 ed. 50. *Aspidium Filix-femina*, Swartz. Sm. Eng. Fl. iv. 282. *Polypodium Filix-femina*, Linnaeus.—Fig: Newm. 237. Franc. pl. 5. fig. 4. Eng. Bot. 1459 (bad). A very variable species, as regards size, outline, division, and density.



ATHYRIUM FILIX-FEMINA.

The following forms, several of which are by some regarded as species, may be distinguished as varieties:—



A. Filix-femina, vars.

- a. *incisum*; fronds broadly lanceolate drooping; pinnae linear or ovate-lanceolate, distinct, deeply pinnatifid, with flat diverging sharply-toothed lobes; sori distinct.—DESC: Newm. Brit. Ferns, 2 ed. 243. Bab. Manual, 2 ed. 413. *Athyrium Filix-femina*, Roth. *Polypodium incisum*, Hoffmann.—FIG: Newm. 243. Of this form I have examples gathered near Guildford, Surrey, the pinnae and pinnules of which are broad and close set, the whole frond appearing densely leafy.
- b. *convexum*; fronds linear-lanceolate, semi-erect; pinnae distinct, very narrow linear convex with deflexed margins, bluntly toothed; sori confluent.—DESC: Bab.

Manual, 1 ed. 388. Newm. Brit. Ferns. 2 ed. 245.

Athyrium rhæticum, Roth. *Polypodium rhæticum*, Linnaeus.—FIG: A seedling or starved form of this variety (*Aspidium irriguum*, Smith; *Athyrium rhæticum minus*, Roth) is represented in Newm. Brit. Ferns, 245.

γ. *trifidum*; fronds ovate-lanceolate semi-erect; pinnules linear-lanceolate sub-decurrent, flat, deeply cut, the apices of the lobes generally trifid.—DESC: Newm. Brit. Ferns. 2 ed. 242. *Athyrium trifidum*, Roth. *Polypodium trifidum*, Hoffmann.

δ. *molle*; fronds ovate-lanceolate semi-erect; lower pair of pinnæ distant short deflexed; pinnules lanceolate decurrent, united by wing of mid-rib, flat toothed; sori distinct.—DESC: Newm. Brit. Ferns, 2 ed. 242. Bab. Manual, 2 ed. 413. *Athyrium molle*, Roth. *Polypodium molle*, Schreber.

ε. *multifidum*; fronds semi-erect, lanceolate; pinnæ narrow-lanceolate, their apex as well as the apex of the frond multifid or tasselled; sori crowded.—DESC: *Athyrium Filix-femina vivipara*, Steele Handb. Field Bot. 215.—FIG: Newm. 248. A very curious and elegant monstrosity, retaining its peculiar characters under cultivation. Found in Ireland, where two forms, slightly differing, but possessing the same general characters have been met with by Mr. J. T. Mackay, and Mr. D. Moore.

ζ. *crispum*; dwarf (6 to 8 in.) slender delicate, crisped; rachis variously forked, the apex of the divisions densely tufted or tasselled; barren. A very distinct form, discovered by Mr. A. Smith, on the hill Orah, in the county Antrim, Ireland; it proves constant under cultivation, and much resembles a tuft of curled parsley.

Dr. Dickie has favoured me with a singular menstrostosity, apparently referrible to this species, but very different from either of the preceding forms. In this the pinnules are developed in a very irregular degree, their margins being irregularly lacerated. It was found in

1846, on Ben Muich Dhui, in Aberdeenshire, at 2,700 feet elevation ; and has maintained the same appearance under cultivation.



A. Filix-femina ciliatum.

The Lady Fern grows with a tufted caudex, which, in old plants of the stronger growing variety, *incisum*, becomes considerably elongated and trunk-like ; from this the black, wiry, fibrous roots are produced. The fronds are, in all cases, of delicate texture, and have, more or less of

a light feathery appearance; they grow up about May, reaching maturity towards the end of the summer, and dying down in the autumn, if not destroyed by early frosts. Their vernation at first is circinate, but by degrees the apex becomes liberated, and hangs down, assuming the appearance of a shepherd's crook, as in *Lastrea Filix-mas*. The general outline of the frond is lanceolate, broadest in the variety *incisum*, and narrowest in *convexum*; *incisum* often grows four or five feet high; *trifidum convexum*, and *multifidum*, from one to three feet; *molle*, from a foot to eighteen inches; and *crispum*, usually about six inches high. The fronds grow up in a large tuft from the crown, the older plants of the larger varieties, sometimes throwing up from twenty to thirty fronds, such examples being noble, as well as lovely; *incisum* has the fronds somewhat drooping; the others, with the exception of *crispum*, are more erect in habit; *crispum* has a spreading, tufted habit of growth. The stipes is surrounded with numerous elongated scales around the base, where it is much swollen, a few smaller scales occurring on the upper part; on the lower part, for a fourth to a third of the height of the plant, the stipes is bare of pinnæ; in the upper part the pinnæ are closer or more distinct, varying much, according to the situation where the plant has been growing. The pinnæ are lanceolate, more or less attenuated; they are distinctly pinnate in *incisum* and *convexum*, the pinnules becoming somewhat decurrent in *trifidum*, and more decidedly so in *molle*. The pinnules have more or less of the lanceolate form; those of *incisum* are flat, deeply pinnatifid, with diverging, sharply toothed lobes; of *convexum* linear, convolute, the margins being notched rather than toothed, and folding over the sori; of *trifidum*, flat, deeply cut, the apices of the lobes generally distinctly trifid, and the first anterior lobe larger than the rest; in *molle*, flat, with toothed margins. The venation is mostly very distinct, from the delicate texture of the frond; its general character is—midvein waved, lateral veins forked shortly after leaving the midvein, the anterior branch bearing on its side the oblong sorus, about equidistant from the midvein and margin, the other branch becoming forked or not, according to the composition of the frond, one branch extending to each serrature: in the larger and more divided pinnules the lateral veins branch alternately, and bear more than one

sorus. The sori are elongate-reniform, or somewhat sausage-shaped, covered with an indusium of the same form, opening towards the midvein, its free margin split into narrow segments. Smith remarks that the sori finally become nearly round, and the indusium orbicular, with a notch at the base, thus assuming in this stage the character of an Aspidium, to which genus he referred the plant. In incisum, trifidum, and molle, the sori are usually distinct; in convexum and multifidum, confluent. The fructification is mature about September.

The species is abundant in most parts of Britain, and particularly so in Ireland; and, no doubt, the varieties incisum, convexum, trifidum, and molle, are pretty generally distributed, though there appear to be no statistics on this point. The other varieties, or monstrosities, are, I believe, only found in Ireland. Warm and moist woods, and hedge-row banks, are the favourite localities of this species; but it is not confined to such situations, although in them it attains its greatest vigour and luxuriance. It also occurs throughout Europe, in Asia, Africa, and North America.

The Lady fern, writes Mr. Lees, in *The Botanical Looker-Out*, is the queen of ferns, exquisitely and super-eminently delicate and beautiful; and he adds some stanzas, one or two of which I must here quote:—

“ By the fountain I saw her just sprung into sight,
Her texture as frail as tho’ shiv’ring with fright;
To the water she shrinks—I can scarcely discern,
In the deep humid shadow, the soft Lady fern.

“ Where the water is pouring for ever she sits,
And beside her the Ousey and Kingfisher fits;
There, supreme in her beauty, beside the full urn,
In the shade of the rock, stands the tall Lady fern.”)

The species does not appear to be applied to any special use, except that, in Ireland, where it abounds on all the bogs, it is employed as a packing material for fish and fruit, as the common bracken is in this country.

There is no difficulty in the cultivation of this very beautiful plant. If planted about rock work, it should occupy a low, boggy situation at the foot of the rock, being planted amongst turfey soil, kept well moistened, either naturally or artificially. It is far less beautiful if planted in dry exposed situations. No object about a piece of rock-work is so beautiful as a vigorous plant of the Lady fern, placed

just within the mouth of a dark cavernous recess, large enough to admit of its development, and just open enough that the light of day may gleam across the dark background of the cavern, revealing the drooping feathery fronds. In such a situation it will grow freely, provided there is a sufficient supply of moisture to its roots. For planting in shady woods, or on the margin of ornamental water, no fern can be more appropriate or beautiful. If grown in a pot, it must have a large-sized one, and should be placed in rough turf soil, which should be intermixed with lumps of charcoal and freestone or potsherds. To attain anything like a fair degree of development, the plants must be kept well supplied with water.

GENUS VIII.

A S P L E N I U M.

ASPLENIUM, *Linnæus* (Spleenwort).—Veins more or less branched free; sori elongate straight, attached along the inner side of veins; indusium opening along the inner edge, which is jagged or entire.—Name latinized from the Greek *asplenon* (from *a*, priv., and *splen*, the spleen), a term applied to some species of fern formerly employed as a supposed remedy in diseases of the spleen.

Among the British species usually ranged under Asplenium, two distinct groups may be recognised. In one of these the pinnules or ultimate divisions have a distinct midvein, throwing out lateral veins, which are either simple or forked; and it is along the inner side of these veins, or of those of the secondary series of veins, which are sometimes found, that the sori are produced. In the

other group there is no midvein, but a series of more or less branched veins in each ultimate division of the fronds, proceeding from the base, and extending to the apex or margin, bearing the sori along their inner side. These differences, together with a total diversity of habit and appearance, are probably sufficient to justify the separation of the latter group; and this, in fact, Mr. Newman has done, applying to it the generic name *Ame-*

Analysis of the Species.

Pinnules with distinct midvein.

fronds bipinnate.

lanceolate.

primary rachis distinctly

winged 1. *A. fontanum.*

primary rachis not winged,
but clothed with narrow

scales 2. *A. lanceolatum.*

triangular 3. *A. Adiantum-nigrum.*

fronds pinnate.

rachis winged. 4. *A. marinum.*

rachis not winged.

black throughout. 5. *A. Trichomanes*

green above 6. *A. viride.*

Pinnules without midvein.

fronds bipinnate, in lusium { 7. *A. Ruta-muraria.*

jagged } raria.

fronds linear pinnate, ind. { 8. *A. germanica-*

entire } acum.

fronds narrow lanceolate { 9. *A. septentrionalis.*

2-3 cleft, ind. entire } ale.

1. *Asplenium fontanum*, R. Brown (smooth) rock Spleenwort; fronds linear lanceolate bipinnate: pinnae oblong ovate; pinnules obovate-cuneate deeply and sharply toothed above; rachis winged throughout.—DESC: *Asplenium fontanum*, R. Brown. Sm. Eng. Fl. iv. 299. Hook. Brit. Fl. 5 ed. 443. Franc. Anal. 3 ed.

48. *Athyrium fontanum*, Presl. Bab. Manual, 2 ed.
 413. *Aspidium fontanum*, Swartz. *Aspidium Halleri*,
 Willdenow. *Polypodium fontanum*, Linn.—FIG : Eng.
 Bot. 2024. Franc. pl. 5, fig. 1..



ASPLENIUM FONTANUM.

The smooth rock Spleenwort is an elegant little tufted plant, with a short scaly caudex, and numerous black smooth fibrous roots. The fronds are from three to six inches high, erect, narrow lanceolate in outline, and of a glaucous green colour, and firm rigid texture, remaining persistent from year to year, the young fronds being produced in the early part of the summer. The stipes is very short, and destitute of scales, except a few narrow pointed ones quite at the base; and both the principal and the partial rachis have a uniform narrow winged margin. The fronds are bipinnate; the pinnae oblong ovate, and the pin-

nules obovate, tapering to the base, with from two to four deep notches, and sharp, somewhat spinous teeth. The venation is rather indistinct, owing to the rigid texture of the fronds: the principal vein of each pinnule throws off a lateral branch to each of the lobes or serratures, and the sori are borne on some of the lower of these lateral branches, near their junction with the midvein. The sori are short, oblong, two or three on each pinnule, sometimes distinct, but sometimes becoming confluent, and occasionally occupying most of the under surface of almost every pinnule, from the base to the apex of the frond; they are covered by an opaque, white, oblong indusium, which is more rounded on the free margin, towards the midrib, than on that by which it is attached; the free margin is waved and indented. The fructification is mature in September and October.

The claims of this species, to be regarded as a native plant, have been questioned, and I cannot, from personal knowledge, vindicate its claim. Most, if not all its recorded habitats have, at various times, and by different persons, been searched in vain. Mr. T. Cox informs me that he has recently, without success, examined that of Amersham church, in Bucks. There are specimens in the Herbarium of the Botanical Society of London, from Cavehill, Belfast, on the authority of Mr. W. O. Newnham; and others from rocks in Wharncliffe Wood, Yorkshire, said to have been collected in 1838, by Mr. R. M. Redhead. I have fronds from a plant found in 1845, growing in company with *Asplenium Trichomanes*, on an old wall, near the mansion of the late D. Heigh, Esq., on Tooting Common, Surrey, where it had certainly not been lately introduced. Possibly the plant has been overlooked; and this seems the more probable as Mr. Hutcheson, the present gardener at Boxley Abbey, informs me he gathered it in 1842 on rock, near Stonehaven, in Kincardineshire. Many localities where it may exist have certainly never been examined by a scrutinizing eye. It is not unfrequent in some other parts of Europe.

Under cultivation this species thrives. It should be carefully potted, so that all superfluous moisture may drain away from its roots and crown, and is best elevated slightly above the level of the soil between two or three pieces of soft stone, such as sandstone. It never attains a great size, and therefore does not require a large pot; and should be kept

in a close shady frame. Peat, charcoal, and sand, form a good medium for its roots. It may be propagated by division of the plant.



ASPLENIUM LANCEOLATUM.

2. *Asplenium lanceolatum*, Hudson (lanceolate or Hudson's Spleenwort); fronds lanceolate bipinnate: pinnae ovate-lanceolate; pinnules obovate deeply and sharply toothed; rachis not winged, but clothed with narrow scales; sori short submarginal.—Desc. : *Asplenium lanceolatum*. Hudson. Sm. Eng. Fl. iv. 298. Hook. Brit. Fl. 5 ed. 443. Bab. Manual, 2 ed. 413. Newm. Brit. Ferns, 2 ed. 249. Franc. Anal. 3 ed. 49.—Fig. : Newm. 249. Eng. Bot. 240.

The lanceolate Spleenwort has a tufted caudex, from which long slender black roots are produced; this caudex is densely covered with bristle-like scales, which are continued, though of smaller size, through the whole length of the stipes and rachis. The fronds are from four to eighteen inches long, and of proportionate width, the stipes being usually of a dark reddish-brown, and forming from a third to half of their entire length. In some states of the plant they are, when expanded, nearly erect, in others drooping, variations which are, no doubt, dependent on the circumstances in which they are placed. They grow up in May, and attain a mature condition by the month of August, remaining persistent through the winter. The outline of the frond is lanceolate, the pinnae standing nearly at right angles with the rachis, and often, but by no means always opposite, the lower pinnae being shorter than those about the middle of the frond, which is hence somewhat ovate in figure; those about the middle of the frond are lanceolate. The texture of the frond is usually rigid, but when developed in dark moist situations, becomes less so. The pinnae are pinnate, except in a rigid, almost linear, form of the plant, in which they are only slightly lobed. The pinnules are usually obovate, but vary considerably in form, being sometimes much attenuated at the base, with the apex rounded, and in other examples blunt both at the base and apex, becoming irregularly quadrate; in all cases they are indented on the margin, with deep sharp teeth; the smaller pinnules are simply toothed on the margin, but the larger ones are often deeply cut, those near the principal rachis being usually seated on a little stalk. The venation is distinct: each pinnule has a somewhat tortuous midvein, from which forked lateral veins are produced, a branch of the vein running out to the point of each serrature. The sori are produced from the side of the lateral veins towards their extremity, without any regular order; they are at first elongate and linear, but become more or less circular in age, the thin white indusium by which they are covered in their earlier stages, being soon obliterated; the mature sori are often large, and frequently quite confluent. The indusium, which opens by its inner edge, is on that side usually slightly lacerated. The fructification is mature in August.

This species is not very abundant, and is chiefly found in

the southern and western counties of England, and two or three of the Welsh counties, and with one or two exceptions only—so far as recorded—near the sea-coast. It is also found in the Channel Islands, but its range seems very limited.

It requires a mild sheltered climate, and is therefore neither suited for ordinary rockwork, nor any other exposed situation. Placed where it may have a moist and calm atmosphere, free drainage at the root, and a moderately elevated temperature, it will grow without difficulty, and has a not inelegant appearance. The soil should be well intermixed with charcoal or other material to act as drainage. It is propagated by division, when more than one crown is formed.

3. *Asplenium Adiantum-nigrum*, Linnæus (black Spleenwort); fronds triangular bi-tripinnate; pinnae and pinnules triangular with sharp teeth; sori elongate: nearly central.—DESC: *Asplenium Adiantum-nigrum*, Linnæus. Sm. Eng. Fl. iv. 297. Hook. Brit. Fl. 5 ed. 443. Bab. Manual, 2 ed. 413. Newm. Brit. Ferns, 2 ed. 255. Franc. Anal. 3 ed. 49.—FIG: Eng. Bot. 1950. Newm. 255. Franc. pl. 5, fig. 3.

β . *obtusum*; fronds smaller, less divided with blunter divisions; rachis winged.—Newm. Brit. Ferns, 2 ed. 258. *Asplenium obtusum* Willdenow.

γ . *acutum*; fronds tripinnate throughout, ultimate pinnules deeply cut into narrow linear sharply-toothed segments.—Newm. Brit. Ferns, 2 ed. 259. *Asplenium acutum*, Bory. Found at Mucruss, and on Cahir Conree, Ireland.

δ . *variegatum*; fronds distinctly variegated with white, otherwise like the common form. Found by Mr. Silver, in 1847, growing on Shottisbrook church, Berkshire.

The black Spleenwort has a tufted caudex, furnished with long, tough, black, wiry roots, and covered with bristly scales, a few of which are scattered over the base of the stipes. The fronds vary much in size, according to the position in which they are grown; sometimes they do not exceed three or four inches in length, and sometimes their



ASPLENIUM ADIANTUM-NIGRUM.

length is as much as two feet; the young ones appear towards the latter end of May, and reach maturity about September, remaining persistent through the winter. The

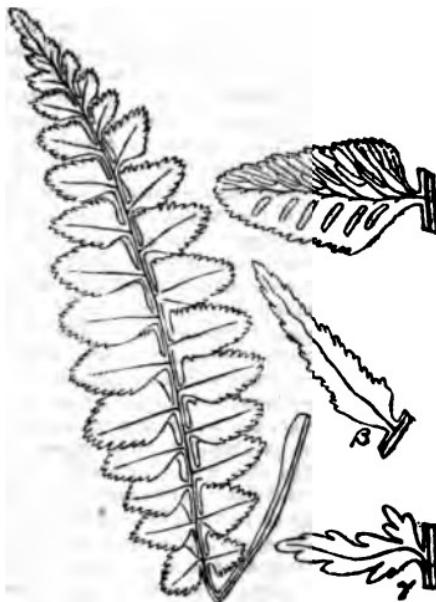
stipes is smooth and shining, and of a dark purple colour, almost black; it is usually about as long as the leafy portion of the frond, and sometimes even longer. The outline of the fronds is triangular, more or less elongated; in the variety *obtusum* least so; they grow erect or drooping, according to the situation in which they are placed. The lower pair of pinnae are always larger than the rest, which become gradually shorter upwards, the frond being often extended into a long attenuated point. The pinnae are pinnate, and elongate-triangular, and stand obliquely, and more or less alternately on the rachis. The pinnules, also, especially those on the lower pinnae, are pinnate, and stand obliquely and alternately. The ultimate lobes of the pinnules are often deeply cut, and the margins are in all cases strongly and acutely serrated. The texture of the fronds is for the most part rigid, when mature. The pinnules have a distinct mid-vein; in the larger ones, which are again pinnate, the lateral veins from this become secondary mid-veins, and in the more compound examples, the lateral veins from these sometimes become tertiary mid-veins; thus the ultimate divisions of the frond, and all the principal lobes, have mid-veins, from which branch out free alternate lateral veins, either simple or branched, and on these, near the junction with the mid-vein, and on the inner side, the fructification is borne. The sori are at first linear, and of considerable length, covered by a narrow white indusium, which bursts with an entire margin on the side towards the mid-vein; this indusium becomes pushed aside as the spore cases advance in growth, and is ultimately altogether pushed off, the sori frequently becoming confluent, and covering the entire back of the frond. The fructification reaches maturity in August and September.

A very common species throughout England and Europe, flourishing under hedge-rows, in the crevices of rocks, and on the decaying walls of ruined buildings.

The black Spleenwort once had a reputed efficacy in the treatment of coughs, asthmas, and similar affections of the chest; but it has not maintained its reputation.

It is a very accommodating and ornamental species for the cultivator, growing well under pot-culture, or planted on artificial rock-work. In the latter situation, its neat habit and glossy evergreen fronds render it very desirable. It may, too, be grown either in exposed or shaded situa-

tions; the chief difference being that, in the latter, it attains a greater degree of luxuriance. It is easily propagated by separating the crowns.



ASPLENIUM MARINUM.

4. *Asplenium marinum*, Lin. (sea Spleenwort); fronds linear pinnate: pinnae ovate or oblong serrated stalked and unequally wedge-shaped at the base; rachis winged.—**DESC:** *Asplenium marinum*, Linnæus. Sm. Eng. Fl. iv. 294. Hook. Brit. Fl. 5 ed. 442. Bab. Manual, 2 ed. 414. Newm. Brit. Ferns, 2 ed. 275. Franc. Anal. 3 ed. 49.—**FIG:** Eng. Bot. 392. Newm. 275. Franc. pl. 5, fig. 2.

5. *acutum*; fronds elongate; pinnae elongated acute.—**FIG:** Newm. 276. Plentiful in Cornwall.

v. lobatum; fronds elongate; pinnae auricled and deeply lobed.—FIG: Florigraph. Brit. iv. 70.

The sea Spleenwort has a black, scaly, tufted caudex, from which long, slender, wiry roots are produced, and by which it is so firmly fixed in its native rocks as to be with difficulty removed. The fronds are linear, or linear-lanceolate, and vary from two to twenty inches long; the more usual size is from six to twelve inches. In vernalation they are simply circinate, the pinnae growing in length after they become unfolded. They grow up about the end of June, or in July, and attain maturity by the latter end of September, remaining fresh and persistent until long after new fronds are produced the following year; it is, therefore, a truly evergreen species. The stipe is smooth, and of a dark purplish-brown colour, almost black at the base, where a few narrow pointed scales are usually attached; it varies from about one-sixth to one half the length of the frond; the rachis is winged throughout. The fronds are simply pinnate, the pinnae being stalked and serrated, and connected by the narrow wing which runs along the rachis. The pinnae vary in form, usually between obtuse-ovate and oblong, the base being always extremely irregular, in consequence of being much produced on the upper side, and reduced on the lower; in the variety *acutum*, the pinnae take a much narrower and more acute and elongated form. The margin is usually serrated, but sometimes crenato-serrate, or even doubly crenate; in the variety *lobatum*, these indentures are much deeper than usual, so that the pinnae become lobed. The venation is very distinct, the mid-vein being prominent, and producing lateral veins, which become forked soon after leaving the mid-vein, bearing on the anterior branch at about midway to the margin, a linear sorus which is covered by a pale-coloured persistent indusium, which opens on the side towards the apex of the frond; in some cases the sorus extends almost the whole length between the mid-vein and the margin. The veins are somewhat thickened at the end, and terminate just within the margin. The fructification is mature in September and October.

This plant, as its name implies, is chiefly an inhabitant near the coast; it has, however, been found in two or three situations inland. Notwithstanding, it must be regarded as a marine species, the fissures of sea-cliffs and the roofs

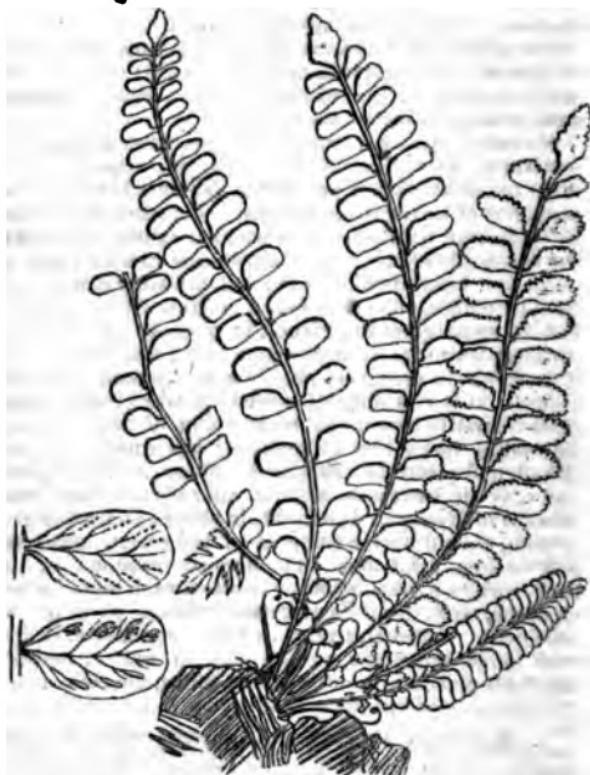
of sea-caves being its favourite haunts. It is by no means uncommon on the rocky coasts of Great Britain and Ireland, and on those of the neighbouring islands; and has also been met with on the coast of France and Spain, in Madeira, Teneriffe, and northern Africa.

It appears that this species was once used medicinally; for Ray recommends it in cases of obstruction, and states that its mucilage, applied externally to burns, is efficacious when other remedies have failed.

No one, as far as I am aware, has been successful in cultivating this plant in the open air; exposed unsheltered to our climate, it perishes. Whether this be in consequence of its requiring warmth and shelter, as indicated by its foreign habitats, or the peculiar saline influences of the sea, as its almost universal position in a wild state may point out, I am unable to say; but probably it is constitutionally tender, since it is found to grow freely enough, in fact, to attain great luxuriance, in a shady position in the ordinary warm moist atmosphere of a plant stove. I find it, however, to grow very readily in a common frame kept closed. It is very difficult to establish when newly removed from its native rocks, the roots being of necessity much injured in the process of removal; but when once established, and placed in a sheltered position, it will grow freely, and may be increased without difficulty by the ordinary process of division. It delights in shade; and, when grown in pots, should have a compost of turfy peat, silver sand, and broken sandstone and charcoal. Planted on shady rock-work in a greenhouse or plant stove, it soon becomes vigorous, and, from its evergreen habit, is at all times ornamental. When cultivated in a common frame, it should have some protection against cold in winter; and is, in fact, best placed with other tender kinds, beneath a hand-glass kept closed in the greenhouse.

5. *Asplenium Trichomanes*, Linnaeus (common Spleenwort); fronda linear pinnate: pinnae roundish-oblong crenated stalked; rachis not winged, black throughout.—Desc: *Asplenium Trichomanes*, Linnaeus. Sm. Eng. Fl. iv. 292. Hook. Brit. Fl. 5 ed. 442. Bab. Manual, 2 ed. 414. Newm. Brit. Ferns, 2 ed. 285. Franc. Anal. 3 ed. 46. *Asplenium melanocaulon*, Willd.—FIG: Eng. Bot. 576. Newm. 285. Franc. pl. 4, fig. 5.

S. incisum; pinnae deeply pinnatifid, with linear notched segments. Rare



ASPLENIUM TRICHOMANES.

The common Spleenwort grows in a dense tuft from its caudex, throwing out numerous black wiry roots, which insinuate themselves in the crevices of the rocks and old buildings where it establishes itself. The fronds are numerous, narrow, linear, simply pinnate, and from about

three inches to a foot in length; they grow up in April and May, and remain vigorous through the winter. The stipes is smooth, shining, and of a purplish black colour, which colour is continued along the also shining rachis to the extreme point of the frond; from about one-sixth to one-third of the the length of the frond, at the base, is void of pinnae. The pinnae are numerous, opposite, or alternate, stalked, of a roundish oblong figure, unequally wedge-shaped at the base, and of a dark green colour; the margin is more or less deeply crenated, and in the variety *incisum* deeply but irregularly pinnatifid with linear serrated segments. When the fronds become aged, the pinnae are readily detached, and eventually fall off like the leaves of a deciduous plant, leaving the persistent rachis quite denuded. The pinnae are usually quite separate, but occasionally they are more crowded, and overlay each other. Each pinna has a distinct mid-vein, from which alternate lateral veins arise; these are forked near the base, the anterior branches bearing the linear sori just beyond the fork; they terminate just within the margin. The sori are at first each covered by a thin pale-coloured membranous indusium, which is of the same form as the sorus, and opens along the side towards the apex of the pinnae, the margin being usually very slightly crenated. The sori are somewhat crowded in the young state, and, as they advance in size, become quite confluent, and ultimately most generally cover the entire under surface of the frond. The fructification is mature in August.

A commonly distributed species throughout the United Kingdom and Ireland, growing on rocks, old walls, ruins, bridges, and more rarely in hedge-row banks. "I once saw it," writes Mr. Newman, "in the valley of the Wye, growing in such profusion on a little bridge near the town of Bault, that it formed a continuous covering of green, and presented a very beautiful appearance. There is scarcely anything in the vegetable world more beautiful than such a scene as this; and it is only known by those who have tried the experiment, how readily such a scene may be transferred to a garden." It is also found throughout Europe, in Asia, in Africa, and in North America.

It appears from the statements of the old writers, that this fern once had a medicinal reputation which it does not now possess. Ray speaks of it as useful in affections of

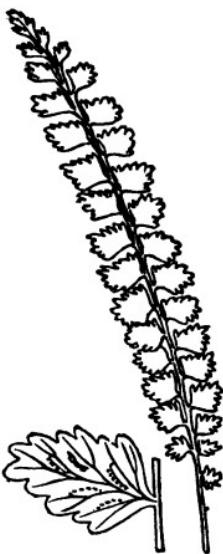
the chest and lungs; and Lightfoot records that the Scotch country people, in his day, made from it a tea and a syrup, which were taken as remedies for coughs and colds. Some old medical books refer to this plant as the source from which the syrup called *Capillaire* is prepared.

It is a very elegant little evergreen plant, suitable for rock-work, growing freely if care be taken not to allow stagnant water to remain about its roots, and to provide it with a shady situation. From its small size, it should, of course, be placed in the more prominent situations in the rockery, or its elegance will be lost sight of. It may be cultivated without the least difficulty in pots, in a compost of turf peat soil, intermixed with sand, broken charcoal, and small lumps of old mortar, and attains its greatest luxuriance when placed in the shade. It is propagated by dividing the tufts when there is more than one crown.

6. *Asplenium viride*, Hudson (green Spleenwort); fronds linear pinnate: pinnae roundish-ovate or rhomboidal crenated stalked; rachis not winged, green above.—DESC: *Asplenium viride*, Hudson. Sm. Eng. Fl. iv. 293. Hook. Brit. Fl. 5 ed. 442. Bab. Manual, 2 ed. 414. Newm. Brit. Ferns, 2 ed. 281. Franc. Anal. 3 ed. 47.—FIG: Eng. Bot. 2257. Newm. 281. Franc. pl. 4, fig. 6.

A. acutum; pinnae "long and pointed." Found by Mr. Gibson, as recorded by Newman.

The green Spleenwort is nearly allied in its habit to the commoner species, Aspl. *Trichomanes*. Its fronds grow in a dense tuft from the caudex, which is dark coloured, and furnished with a few narrow pointed scales, producing also long black slender roots, by which it fixes itself to its native rocks. The fronds are narrow linear, and simply pinnate, varying from two to eight or ten inches in length, according to the circumstances of exposure or shelter under which it has grown; they grow up in May and June, and remain green through the winter. In vernalation they are closely curled inwards, and in a young state are covered with fine scales, which are, however, soon lost. The stipe is smooth, usually about a third the length of the entire frond, dark purplish-brown on more or less of the naked portion at the base, but otherwise green, the green colour being continued along the rachis to the apex. The pinnae

*ASPLENIUM VIRIDE.*

are attached by slender stalks, mostly but not invariably alternate, and usually more distant in the lower than in the upper part of the frond; they vary considerably in form, but mostly between roundish-ovate and rhomboidal, usually tapering to the base, but sometimes broadest at the base, and much shortened and rounded at the apex; in acutum the apex is lengthened out. The margin is deeply crenated; the colour is a bright cheerful green. The mid-vein of the pinnae is distinct, sending off lateral branches, which are either simple or forked, in the latter case the division being either beyond or opposite to the sori; these lateral veins seldom reach the margin. The sori are at first covered by a narrow lanceolate membranous indusium, which is soon pushed aside by the sori, which not unfrequently become confluent; the margin of the indusium is sometimes jagged or crenate. The fructification is mature in August.

This species occurs, not very commonly, in the mountainous rocky districts of England, Wales, and Scotland, and less commonly in Ireland, delighting in the vicinity of waterfalls. It is found throughout Europe.

Usually a free growing plant under cultivation, not, however, often attaining the size which it acquires in sheltered places amongst the moistened rocks, in the interstices of which its roots delight to insinuate themselves, often so firmly as to render it next to impossible to extricate the plants uninjured. It requires well drained pots, and sandy peat soil, intermixed plentifully with small lumps of charcoal or broken freestone, and delights in a damp shady situation, provided the moisture is not too nearly stagnant. In the rockery it needs similar treatment with the common Spleenwort. Propagated by dividing its tufted caudex occasionally.

7. *Asplenium Ruta-muraria*, Linnaeus (rue-leaved Spleenwort, or Wall Rue); fronds bipinnate; pinnae rhomboid-wedge-shaped notched; indusium jagged on the margin.—*Desc.*: *Asplenium Ruta-muraria*, Linnæus.



ASPLENIUM RUTA-MURARIA.

Sm. Eng. Fl. iv. 296. Hook. Brit. Fl. 5 ed. 442.
Bab. Manual, 2 ed. 414. Newm. Brit. Ferns, 2 ed. 261.
Franc. Anal. 3 ed. 45. *Amesia Ruta-muraria*, Newman.
Scolopendrium Ruta-muraria, Roth.—FIG.: Eng. Bot.
150. Newm. 261. Franc. pl. 4, fig. 3.

The Wall Rue is a tufted growing plant, throwing out long, black, tough, wiry roots from its thick caudex, which is clothed with bristly scales. The fronds are numerous, green, from an inch to six inches or more in length, growing up in May and June, and lasting green through the succeeding winter. The stipe is slender, naked for more than half the length of the frond, smooth, and green, except at the base, where it is blackish-purple. The frond is triangular in outline, and usually bipinnate in composition, sometimes, however, in young or starved specimens, only pinnate, and at other times, when very luxuriant, bipinnate and pinnatifid, or almost tripinnate. The pinnae, as well as pinnules, are alternate, the latter rhomboidal, or roundish ovate, or obovate, or sometimes cuneate, with the apex truncate: usually, however, the base of the pinnules is wedge-shaped, and the rhomboidal outline may be traced; the apical margin of the pinnule is irregularly toothed or notched. The ultimate divisions of the fronds are without any distinct midvein, but a series of veins arise from the base, spreading out towards the outer margin, and becoming branched in their progress, the number of branches usually corresponding with the number of marginal teeth. On the inner side of these veins the sori are produced, several on a pinnule; they are covered by a long narrow membranous indusium, soon obliterated by the spreading sori, which become confluent, and usually at length cover the entire under surface; the margin of the indusium is jagged or sinuated in an irregular manner. The fructification is mature in September.

A very common species, found in the fissures of rocks, and more abundantly on old walls, exhibiting a predilection for brick walls. It is generally distributed over Europe, and is not uncommon in some parts of North America.

Formerly reported to possess pectoral qualities, but now disregarded.

This, and the two next species, as regards cultivation, associate well with *Asplenium viride*.



ASPLENIUM GERMANICUM.

8. *Asplenium germanicum*, Weiss (alternate or Weiss's Spleenwort); fronds linear alternately pinnate; pinnules narrow-wedge-shaped, the lowermost three cleft; indusium entire on the margin.—DESC.: *Asplenium germanicum*, Weiss. Newm. Brit. Ferns, 2 ed. 265. Bab. Manual, 2 ed. 414. *Asplenium alternifolium*, Wulfen. Sm. Eng. Fl. iv. 296. Hook. Brit. Fl. 5 ed. 442. Franc. Anal. 3 ed. 44. *Asplenium Breynii*, Retz. *Amegium germanicum*, Newman. *Scolopendrium alternifolium*, Roth. — FIG.: Eng. Bot. 2258. Newm. 265. Franc. pl. 4, fig. 2.

The alternate Spleenwort is a very delicate plant, having a tufted caudex, from which the branched black wiry roots are produced. The fronds grow up in the spring, several

from the crown, and flourish during the summer, but often perish in the winter; they are from three to six inches high, narrow linear, and pinnate, with distant, alternate, narrow, wedge-shaped pinnæ, which are narrowed gradually at the base into a very slender footstalk, by which they are attached to the rachis. The stipes is slender, about half the length of the frond, smooth, and dark purple coloured, the rachis being for the most part green. The pinnæ are ascending, toothed or notched at the apex, two or three of the lowermost being slightly compound, from the presence of two lateral lobes alternately placed. The pinnæ are without a distinct midvein, the veins arising from the base, and becoming branched, so that a branch extends towards every tooth by which the apex is divided, thus producing two, three, four, or more sub-parallel longitudinal veins, according to the development of the pinnæ; two or three of these veins bear along their inner margin each a sorus, which is covered by a linear membranous indusium, having an entire or sinuous, "but not jagged," free margin; these sori at length become confluent, obliterating the indusium. The fructification is mature in August and September.

One of the rarest of our native ferns, having never been found wild in England, Wales, or Ireland, and only in a very few situations in Scotland. In some other European countries it is found, but nowhere common.

9. *Asplenium septentrionale* Hull (forked Spleenwort); fronds linear-lanceolate, two-three-cleft; segments alternate elongate-lanceolate bifid; indusium entire on the margin.—DESC.: *Asplenium septentrionale*, Hull. Sm. Eng. Fl. iv. 295. Hook. Brit. Fl. 5 ed. 442. Newm. Brit. Ferns, 2 ed. 269. Bab. Manual, 2 ed. 414. Franc. Anal. 3 ed. 44. *Amesia septentrionale*, Newman. *Acrostichum septentrionale*, Linnæus. *Scolopendrium septentrionale*, Roth.—FIG.: Eng. Bot. 1017. Newm. 269. Franc. pl. 4, fig. 1.

The forked Spleenwort produces a tufted caudex, often forming a very large mass; numerous long slender branched fibres serve to hold it to the rocks on which it grows. The fronds are small and slender, often very numerous, from two to four inches long, of a dull green colour, except quite at the base of the stipes, where they are dark brown-purple. The outline of the frond is narrow elongate lanceolate, nar-



ASPLENIUM SEPTENTRIONALE.

rowing downwards into the smooth stipes. The upper or leafy portion is cleft into two or three narrow segments: sometimes they are deeply cleft, the lobes narrowing downwards, and having a bifid apex, and one or two short lateral sharp pointed, often bifid teeth; sometimes they are less divided, the lateral divisions of the frond being merely enlarged bifid teeth; sometimes the lobes are still more reduced into mere teeth, and the frond lengthens out into a slender curved apex; the lateral lobes, therefore, appear either simply slit away from the main division, or they are so deeply divided and narrowed downwards as to assume the appearance of distinct pinnae. The veins are nearly simple, that which extends into each division of the frond proceeding directly from the base, and becoming forked upwards in those cases where the lobes are furnished with bifid teeth, one branch running into each serrature; most of these veins bear a sorus on the inner side; the central lobe has usually one branch, of its vein running parallel with, and near to each margin, and each of these bears a long narrow sorus attached to the inner side, the indusium opening by the edge next the centre. From the opposite pe-

sition of these veins, and proximity of the sori, which open face to face, some resemblance to the twin fructification of *Scolopendrium* is produced; the true nature of the sori is, however, sufficiently evident in the earlier stages of development, when they are seen to be perfectly distinct, each having its own indusium. The sori are covered by a linear membranous indusium, the free margin of which is entire; as the spore-cases swell, this is pushed back, and finally lost, the sori becoming confluent, the entire surface being covered by the spore-cases; in this state the plant acquiring the technical character of *Acrostichum*, to which genus Linnæus referred it. The fronds are persistent through the winter, the young ones appearing about April. The fructification is mature in August.

This is a rare species, confined to a few English, Welsh, and Scotch counties, and apparently not found at all in Ireland. It is, however, not unrequent throughout Europe, most common in the south.

It is somewhat tender, the young growth being liable to suffer from frosts. Under slight protection, however, it succeeds well with the treatment given to the allied diminutive species. It grows very fine in turfy peat soil.

GENUS IX.

CETERACH.

CETERACH, *Willdenow*.—Mid-vein distinct, lateral veins branched anastomosing near the margin the extremities free; sori elongate, attached (except the lowest) to the anterior side of the anterior branch of each lateral vein; indusium obsolete [“narrow, nearly erect, attached to the bark of the vein”]; under surface of the frond densely scaly.—The name

Cetherak was applied to this plant by the Arabian and Persian physicians.



CETERACH OFFICINARUM.

1. *Ceterach officinarum*, Willdenow (scaly Spleenwort); fronds pinnatifid or pinnate: pinnæ sessile oblong-obtuse, entire or lobed on the margin; under surface of fronds densely clothed with imbricated chaffy scales.—DESC: *Ceterach officinarum*, Willdenow. Newm. Brit. Ferns, 2 ed. 293. Bab. Manual, 2 ed. 414. Hook. Brit. Fl. 5 ed. 436. *Notolepium Ceterach*, Newm. p. 9. *Asplenium Ceterach*, Linnæus. *Scolopendrium Ceterach*, Symons. Sm. Eng. Fl. iv. 302. *Grammitis Ceterach*, Swartz.—FIG: Eng. Bot. 1244. Newm. 293. Franc. pl. 1. fig. 1.

The scaly Spleenwort has a brown scaly tufted caudex, with branched tufted penetrating roots. The fronds are persistent through the winter, the young ones springing up in May, and subsequently during the summer; they vary from two to six or eight inches long, and form a pretty green tuft when viewed from above, the green of the upper

surface well contrasting with the pale-coloured scales seen on the back of the half-unrolled fronds; the face of the rachis is slightly scaly. The stipes is short and stout, dark-coloured at the base, and clothed with small brown narrow pointed scales. The fronds are pinnatifid or pinnate; that is, they are either divided quite down to the midrib, the pinnæ being quite separate and quite sessile, or the pinnæ are closer together, and not so perfectly separated, their base being extended in each direction so as to form a connecting wing; the pinnæ are mostly, but not always, alternate in their arrangement. The entire under surface of the fronds is clothed with a dense imbricated covering of small narrow pointed shining scales, which are at first whitish, but change to a light brown; the points of some of these scales project beyond the margin of the pinnæ, giving them a ciliated appearance. The venation is tolerably distinct when young fronds are examined; but, from the thick texture of the fronds, becomes more obscure as they get older, or when dried. From the posterior basal corner of the pinnæ or lobe, whichever it be called, a vein branches out obliquely from the midrib or rachis, and extends in a sinuous course towards the apex of the pinnæ, but nearer the lower than the upper margin; this produces alternate branches, the first of which is directed upwards, and this alone bears two sori, one on each of the two branches into which it separates, the first directed towards the base, and the other towards the apex of the pinnæ; the other lateral veins become branched near the base, the anterior branch bearing a sorus on that side which is towards the apex of the pinnæ; consequently all the sori, except the lowest, are attached to the anterior side of the anterior branch of the lateral veins. These branches, however, become again branched near the margin, anastomosing in an irregular manner, the free points extending almost to the margin. The sori are oblong, at first concealed by the scales, and at no time very apparent from the resemblance in colour between them and the scales on the mature fronds; the spore cases are attached to the side of the veins, as already explained, and immediately behind them, seated on the back of the vein, is a slightly elevated membranous ridge, which is all I can find of an indusium.*

* Newman says: "Attached to the back of the vein is an erect white membranous involucrume, exactly corresponding in length with

The fructification is mature in August and September.

This plant is found growing on rocks, ruins, churches, old walls, and similar situations, pretty generally distributed over the south, west, and north of England, in many of the Welsh counties, abundant in Ireland, and rare in Scotland. It occurs in all the southern and middle countries of Europe, and in the north of Africa.

It was formerly used in medicine, but now disregarded; it was reputed a diuretic.

A free growing species under cultivation when once established. It dislikes close confinement, and requires a very porous soil; in fact, it should have a good proportion of old mortar, and broken charcoal and freestone, in the compost in which it is planted. It may be grown either in pots, or planted out on rockwork; and is not very particular as to the situation, but grows finest in the shade. It is propagated by division of the plant.

GENUS X.

S C O L O P E N D R I U M.

Scolopendrium, Smith.—Lateral veins twice bifurcate, free at the margins; sori elongate straight in pairs attached to the anterior and posterior branches of adjoining veins; indusia of each pair opening face to face, the spore cases becoming confluent into one linear mass.—Name derived from *Scolopendra*, the name of an insect to the feet of which the lines of fructification bear some resemblance.

the line of capsules with which it is connected. In a very early stage of the plant, I have found this somewhat incumbent on the capsules, but it soon assumes its erect position; and as the capsules advance, its character is lost, and it is only to be recognised by those who have made themselves thoroughly acquainted with it in its earlier stages."

The structure of this genus does not accord with that of the three Amesian *Aspleniums* referred to it by Roth; nor with that of *Ceterach*, which Sir J. E. Smith regarded as a *Scolopendrium*. Of the only British species referrible here, there are several remarkable and highly interesting varieties.



SCOLEPENDRIUM VULGARE.

1. *Scolopendrium vulgare*, Symons (common Hart's Tongue); frondis oblong strap-shaped with a cordate base, smooth; stipes shaggy with thin narrow scales.—
DESC.: *Scolopendrium vulgare*, Symons. Sm. Eng. Fl. tv. 301. W. Hook. Brit. Pl. 5 ed. 443. Bab. Man. 2 ed. 414. Newm. Brit. Ferns, 2 ed. 289. Franc. Anal., 3 ed. 52. *Scolopendrium officinarum*, Swartz. *Scolopendrium Phyl-*

litis, Roth. *Asplenium Scolopendrium*, Linnæus. *Phyllitis Scolopendrium*, Newm.—FIG: Eng. Bot. 1150. Newm. 289. Franc. pl v. fig. 5.
β. *polyschides*; fronds linear, the margins deeply and irregularly lobed and crenated; fertile.—*Phyllitis polyschides*, Ray.
γ. *crispum*; fronds lanceolate, the margins much waved and crisped; barren.
δ. *lobatum*; fronds dilated at the apex and cut into lanceolate lobes.
ε. *multifidum*; fronds forked (often repeatedly) towards the extremity; fertile; sometimes waved at the margin, and then barren.—*Phyllitis multifida*, Ray.
ζ. *ramosum*; stipes branched, branches dilated at the apex, and divided into numerous unequal crisped lobes. The common Hart's tongue has a tufted caudex, producing long black wiry roots. The fronds, which are produced in the spring about April, remain vigorous through the winter, rendering the plant evergreen; their vernation is circinate; as they are developed they become erect, with the apex circinate, but by degrees they assume a gracefully drooping habit. The stipes occupies a third or less of the length of the fronds, and is of a brown purple colour, somewhat shaggy, with thin narrow scales, which are continued along the back of the mid-rib; it is usually simple, but in the variety *ramosum* becomes divided into two or three branches. The fronds are narrow elongate lanceolate, usually acute at the apex, and cordate at the base, but sometimes the apex is obtuse, sometimes much dilated as in the varieties *lobatum*, *multifidum*, and *ramosum*; sometimes the margin is plain and entire, at other times, as in the varieties *crispum* and *polyschides*, either much waved and crisped or deeply crenato-lobed; in size they vary from six inches to two feet in length. The frond is very succulent when young, becoming thick and leathery as it gets mature, and having a full green tint above, somewhat paler beneath. From the mid-rib of the frond the veins issue on either side, each soon becoming forked, and these two branches becoming again forked at about one-third the distance from the rib to the margin; beyond this the branches usually extend in nearly parallel lines to the margin, though

here and there they become again forked near the extremity; the cordate base of the frond is filled out by a more compound series of furcations. The sori which, when considerably developed, have all the appearance of simple linear masses, lying obliquely across each half of the frond, are in fact compound, consisting of two lines of spore cases, each originally covered by a separate indusium, but eventually becoming confluent, and superficially losing all trace of their twin origin; these two lines of spore cases arise from separate series of veins, one line being attached to the upper side of the foremost branch of one series, and the other line to the lower side of the lowest branch of the series next beyond, and so on all over the frond; they are each covered with a pale-coloured membranous indusium, which is so attached, that the free margin is exterior as regards the set of veins to which it is attached. The two indusia which cover the double line of spore cases forming the twin sori, and which at first touch each other, open therefore in opposite directions, like a pair of folding doors; they become pushed back by the growing masses, and eventually lost, the spore cases becoming so united as to form one crowded line. The sori are of unequal length, and usually most abundant on the upper two-thirds of the frond. The fructification is mature in September.

This is one of our common native species being almost universally distributed, very abundant in Ireland, less so in Scotland. It occurs on walls and ruins, on hedge-banks, among thick bushes and in the interior of wells, in the latter situation acquiring extraordinary vigour. It is found all over Europe. The varieties though recorded as having been originally found wild, are not often met with, and are chiefly known as cultivated plants.

The medicinal virtues for which the species was formerly in repute, are now disregarded. It was said to be used, boiled in red wine, as an astringent in cases of diarrhoea and haemorrhage, and to form an ointment for the healing of wounds and ulcers. According to Lightfoot, it was in his day used by the Scotch rustics in the form of an ointment as a vulnerary, for burns and scalds.

It is a very distinct looking fern, and highly ornamental on rock work, from which neither the species nor its varieties, should be absent. It is, moreover, a very free growing plant, thriving in any situation, though acquiring its

greatest perfection in shady humid places. As a pot plant it requires considerable scope for its roots. It increases by dividing its crowns.

GENUS XI.

A D I A N T U M.

ADIANTUM, *Linnæus* (Maidenhair).—Veins repeatedly branched from the base of the pinnales, and radiating to the margin, free: sori marginal oblong or roundish; indusia consisting of membranous prolongations of distinct reflexed portions of the margin of the frond.—Name derived from the Greek *adiantos* (dry, unmoistened), the plant possessing the property of repelling water.

1. *Adiantum Capillus-Veneris*, Linneaus (true Maidenhair); frond doubly-compound, pinnae alternate unequally wedge-shaped with capillary stalks, lobed; lobes of the fertile pinnae reflexed over the transversely oblong sub-marginal sori, and prolonged into membranous indusia, the sterile lobes serrated.—DESC.: *Adiantum Capillus-Veneris*, Linneaus. Sm. Eng. Pl. iv. 307. Hook. Brit. Fl. 5 ed. 445. Newm. Brit. Ferns, 2 ed. 83. Bab. Manual, 2 ed. 415. Franc. Anal., 3 ed. 59.—FIG.: Eng. Bot. 1564. Newm. 83. Franc. pl. 6, fig. 3.

The true Maidenhair fern has a black, scaly, slowly-creeping caudex, with dark-coloured, wiry roots. The fronds, which are very delicate and graceful, appear in May, becoming fully grown by the height of summer, and retaining their freshness through the winter, if duly sheltered; they grow from six inches to a foot in height, and usually assume a more or less drooping position. The stipes is slender, dark purplish black coloured and shining.



ADIANTUM CAPILLUS-VENERIS.

a few narrow pointed scales being attached to its extreme base, and from a half to two-thirds of its lower extremity, being destitute of pinnae. The fronds are of irregular outline, sometimes approaching a triangular form, and in other instances being elongate-lanceolate; they vary from six to twelve inches in length, and are twice pinnate, the lower pinnae becoming divided into a variable number of pinnules, which, as Newman observes, "are not apparent on their first expanding; three or five pinnae only appear, and these in a few days become divided into pinnules." The shape of the pinnules is very variable, but few having

the same form ; they are usually irregularly wedge or fan-shaped, the fertile ones being more or less deeply cut on the margin, and the barren ones sharply serrated ; both the pinnae and pinnules are alternate. The entire rachis is slender and hair-like, but most especially so the little stalks by which the pinnules are attached ; and when after the period of maturity the pinnules fall off, these capillary divisions of the rachis remain persistent like a loose tuft of bristles. The texture of the frond is thin and delicate, and the colour a bright cheerful green. The venation is peculiar, and consists of a series of dichotomous ramifications of the rachis, the first ramification forming the extreme base of the pinnule, these branches becoming several times again forked, so as to occupy the pinnule with a series of contiguous radiating veins ; in the sterile portions of the fronds one of these veins is directed to each marginal serrature, in which it terminates, but in the fertile parts they each terminate in the reflexed apex of the lobes within the margin, mostly bearing at the extremity a small roundish sorus ; these soon become confluent into a linear series, lying crosswise near the apex of the reflexed bleached portion of the lobes, which serves as an indusium. The fructification is mature in July.

A most delicate and graceful, as well as very local species, found in moist caves and attached to moist rocks, preferring the vicinity of the sea. Newman says it prefers a perpendicular surface, whence its fronds grow almost horizontally ; and Sir W. J. Hooker states that he has seen it lining the inside of wells with a tapestry of the tenderest green. It is stated to occur in England, Wales, Scotland, and Ireland ; and otherwise has a wide geographical range, comprehending the middle and south of Europe, Asia, the northern parts of Africa, and the Canary and Cape de Verd Islands.

It is reported to possess expectorant and diuretic virtues, and to be the source whence the syrup called *Capillaire* is prepared, but the statements concerning this are very contradictory, *Adiantum pedatum* and *Asplenium Trichomanes* being also said to furnish it. According to Mr. Ball, the people of the south isles of Arran use a decoction of the leaves in place of tea.

This fern does not bear exposure, but, placed in a confined damp atmosphere, it flourishes, attaining its greatest

luxuriance where it is supplied with a moderate degree of warmth. Under these circumstances, and potted in a compost of turf-peat largely intermixed with pure sand, and small lumps of broken crocks and charcoal, it may be regarded as a free grower. On exposed rock-work, in the open air, I have never known it to survive through the winter, and the situation must be very favourable for it to make much progress under such circumstances, even in summer. A damp, close, warm medium for its fronds and a rocky medium for its roots seem to be its principal requirements. It is essentially a shade-loving plant. On rock-work either in a stove or greenhouse, it flourishes well, and also in a Wardian case, for which latter situation it is, by its superlative elegance, peculiarly fitted. I find a remark by Mr. Taylor, which is worth quoting as an exemplification of a use to which many ferns, exotic as well as native, might be well applied; it is this:—"Two fronds with two spikes of mignonette at the back of a white Camellia, make a splendid bouquet." The Maidenhair fern is propagated by careful division of its caudex.

GENUS XII.

B L E C H N U M .

BLECHNUM, Linnaeus.—Mid-vein distinct, lateral veins (of fertile fronds) anastomosing in a longitudinal series on each side of and parallel to the mid-vein; spore cases borne in a continuous narrow line on the inner side of each anastomosing vein, covered by a continuous indusium bursting on the inner side.
—Name latinized from *blechnon*, a Greek name for a fern.

1. *Blechnum Spicant*, Withering (Hard Fern); fronds of two kinds linear-lanceolate; fertile fronds erect pin-



~~BRACHYTRUM SPICANT.~~

nate with linear acute reflexed pinnae, barren ones prostrate pinnatifid; with broadly-linear blunt flat lobes. —Desc.: *Blechnum Spicant*, Withering (1790), *Blechnum boreale*, Swartz, (1800). Sm. Eng. Fl. iv. 303. Hook. Brit. Fl. 5 ed. 444. Bab. Manual, 2 ed. 415. Franc. Anal. 3 ed. 53. *Lomaria Spicant*, Willdenow. Newm. Brit. Ferns, 2 ed. 89. *Osmunda Spicant*, Linnaeus. *Osmunda borealis*, Salisbury. *Acrostichum Spicant*, Sibthorp. *Asplenium Spicant*, Bernhardi. *Onoclea Spicant*, Hoffman.—Fig.: Eng. Bot. 1159. Newm. 89. Franc. pl. 5, fig. 6.

The Hard Fern has a thick tufted scaly caudex, with numerous black, tough wiry roots. The fronds perish in the winter, the young ones springing up about May, and attaining maturity by the end of the summer. The barren ones are shorter than the fertile, of a narrow elongate-lanceolate outline tapering to both extremities, pectinate-pinnatifid, with close flat oblong obtuse segments somewhat curved in the direction of the apex of the frond, and having a prominent mid-vein with slender forked lateral veins, the branches of which each terminate just within the margin in a small, transparent, club-shaped head; these fronds usually lie in a nearly horizontal position, and are attached by a short, dark-coloured, slightly scaly stipe. The fertile fronds grow up from the centre of the tufts, and are usually quite erect; they vary from one to two feet in height, and are narrow elongate lanceolate, pinnated, with linear acute pinnae; the stipes, from a third to half the length of the frond, is dark purple, smooth, with a few small scattered scales near the base, and the rachis is of the same colour; the pinnae are narrow linear, curved towards the apex of the frond, convolute at the margins, and covered on the under side with the confluent lines of spore cases. The venation is very peculiar. Each pinna has a distinct mid-vein from which alternate lateral veins arise; these lateral veins extend about half way to the margin, and then each turns at a right angle, proceeding up the pinna until it reaches the next vein, with which it becomes united; a longitudinal vein on each side the mid-vein and about equi-distant between it and the margin, is thus produced. To the inner side of these longitudinal portions of

the combined lateral veins the spore cases are attached in a continuous series; by their growth the cuticle becomes raised in the form of an indusium, and at length bursts on the inner margin, splitting up at intervals where the lateral veins have arisen. The fructification is mature in August and September.

A common species occurring commonly in stony and heathy places, and showing itself to be fond of moisture. It is also generally distributed throughout Europe.

Of easy culture, and extremely hardy, forming a splendid rock plant, and also luxuriating in swampy boggy places. It is, moreover, easily obtained, and propagates readily by division of its crowns.

GENUS XIII.

P T E R I S .

PTERIS, *Linnaeus*.—Mid-vein distinct, lateral veins twice forked, united by a marginal vein, to which the spore cases are attached in a continuous line; indusium formed of the bleached reflexed margin of the pinnules.—Name, the Greek *pteris* (a fern) from *pteron* (a wing or feather) applied in allusion to the expanded form assumed by the fronds.

The *Pteris aquilina*, our only British species of the genus, is certainly the most common indigenous fern, often entirely over-running extensive tracts of country. There appear to be at least two very distinct forms of this plant, which, from their extreme commonness, have almost escaped notice: one of these has the lobes of the pinnules entire, in the other they are more or less pinnatifid, which latter appears to be the plant *Linnæus* described. These differences are cer-

tainly not caused by difference of soil and situation, as the two forms may often be found growing inter-



PTERIS AQUILINA.

mixed. The *Pteris aquilina* is the female fern of the older authors.

1. *Pteris aquilina*, Linnæus (common Bracken or Bracken); fronds bi-tripinnate; primary pinnae in pairs; ultimate pinnules sessile, upper ones smaller, the terminal one elongate.—A variable plant. Newman proposes for it the name *Eupteris aquilina*.

- a. *vera*; pinnules: inferior pinnatifid (sometimes only sinuate), the segments oblong-obtuse; superior undivided.—DESC: *Pteris aquilina*, Linnæus. Sm. Eng. Fl. iv. 305. Hook. Brit. Pl. 5 ed. 444. Bab. Man. 2 ed. 415. Franc. Anal. 3 ed. 55.—FIG: Eng. Bot. 1679. Franc. pl. 6, fig. 1. Deskin Florigraph. Brit. iv. '54. This appears to be the form characterized by Linnæus.
- b. *integerrima*; pinnules throughout entire, except occasionally one or two of the lowest on the basal secondary pinnae slightly lobed.—FIG: Newm. 93. Deskin Florigraph. Brit. iv. '55. Apparently distinct as a variety.

Sometimes diminutive states of the former variety have the pinnules considerably waved on the margin, and the fronds then have a crisped appearance.

The common Bracken has an extensively creeping caudex, often forming thickly interwoven usually horizontal masses just beneath the surface of the soil; it is thick, succulent, and of a dark brown colour, almost black, and somewhat velvety externally, and having brown fibrous roots. The fronds are very variable in size; sometimes on walls but a few inches high, on poor gravelly soil from 6 to 18 inches, and on richer soil of different degrees varying from this up to ten feet in height; the form also varies—the smaller states being usually somewhat triangular, and the larger much more elongated. The stipes is rather above half the length of the frond, and is green, somewhat pubescent when young, and angular, with sharp edges, which inflict severe wounds if the plants be incautiously pulled; the part under ground is black, velvety, and spindle-shaped; a transverse section presents a figure by some thought to resemble the imperial eagle (whence the specific name), by others an oak tree. The young fronds grow up in May,

and being extremely tender, are often killed down by late frosts; they become mature by the latter end of July, and are invariably killed early by the autumnal frosts, and become of a reddish brown colour, but from their rigid texture, they maintain for some time their form and position; in the course of the winter, however, becoming broken down by the wind and rain. When they first grow up they are very brittle, and the tops are bent down against the stipes, from which position they rise and expand gradually; they are produced singly at intervals along the caudex. The composition of vigorous fronds is thrice pinnate; sometimes, when grown in exposed situations the first pair of pinnae are unusually enlarged, giving to the frond a kind of tripartite appearance; but under other conditions, the primary rachis becomes extended, throwing out at intervals the almost opposite bipinnate pinnae, several pairs being in many cases produced; the form of the primary pinnae is usually ovate, of the secondary pinnae narrow-lanceolate, the former being nearly opposite in distant pairs, and the latter near together, either opposite or alternate along the secondary rachis. The pinnules are attached by their base without a footstalk, either alternately or opposite along the tertiary rachis, becoming confluent towards the apex of the pinnae, the terminal being often considerably larger and more elongate than the confluent pinnules near it; their form is either obtusely oblong and entire in the variety *integerima*, or oblong-lanceolate and deeply pinnatifid (sometimes only sinuate), the lobes being oblong-obtuse in what I take to be the *aquilina* of Linnæus. The variation of the two varieties differs only in what is evidently dependent on their difference of composition. Thus, in the simpler form, each pinnule has a prominent mid-vein, from which, on each side, lateral veins are produced; these are forked either close to or just after leaving the mid-vein, and have a direction towards the apex of the pinnule each of the branches becoming forked at a variable distance from the margin, to which these secondary branches extend. In the more compound form the mid-vein throws off a series of veins, which become mid-veins to the lobes, and these give out a further series of lateral veins, which are either simply forked, or sometimes twice forked, and extend to the margin; the lowest branch right and left of the mid-veins of the lobes usually meet and unite, forming a

rather irregular longitudinal vein parallel with the mid-vein of the pinnule. Along the edge of the pinnules, and also of the lobes and interstices, extends a marginal vein, to which the ends of the other veins are united; this marginal vein bears the fructification, the spore cases being arranged on it in a continuous line, and covered by a bleached membranous reflexed extension of the epidermis of the upper surface of the frond, which serves as an indusium; the epidermis of the under surface of the frond being also extended in a similar way, forming a membrane on which the spore cases lie; both these membranes are fringed at the margin with jointed hairs. The fructification is mature in July and August. The plant has, especially when young, a strong peculiar odour. Weak plants are only bi-pinnate.

This, as already remarked, is the most common of our indigenous ferns, found abundantly on every description of soil, except chalk, which it appears to shun, as it does the habitation of man, "taking refuge," as Newman observes, "in wastes and wildernesses." It is extensively distributed throughout Europe, and is found in Asia and Africa. When growing in exposed situations, it assumes a rigid and somewhat uncouth aspect, but when seen in its most luxuriant state, it is a plant of surpassing beauty. Certainly I have nowhere seen, among our native species, such a scenic effect as was produced by this species, growing eight or ten feet in height, skirting a hedge-row bank by the side of a damp shady lane, its expansive and luxuriant fronds gracefully arching out from among the brushwood which concealed and supported their lower parts. For any such damp half-shady positions in artificial wilderness scenery, this species, common though it be, deserves to be recommended.

It is applied to various uses. The under-ground succulent stems abound in starch, and, as stated by Lightfoot, have been used in different countries as an ingredient in making a miserable kind of bread; they have also been employed in brewing ale in the proportion of one-third to two thirds malt. Mr. A. Forsyth obtained a substance like coarse brown flour, by grating the clean-washed stems, washing the pulp, and straining it through a fine wire sieve. By first scraping off the brown outer coating, white fecula was obtained, which, when boiled, had no disagreeable taste. The fecula, he says, may be easily converted into

malt, and, mixed with a very small quantity of real malt will produce good beer. Both the underground stems in winter, and the tender shoots in May, make, when boiled, a very nutritious article of food for pigs, but is not proper for young ones. The young succulent fronds also make an excellent green manure, if cut and dug or ploughed in immediately. The dried fronds form a very durable thatch, for which purpose they should be pulled up in October, when perfectly pliant; they are, besides, valuable as litter, and even sometimes mixed with hay as fodder for cattle; and are one of the best of all protecting materials in gardens, and are much used as a packing material. The plant abounds in alkali, which is turned to considerable account in the manufacture of soap and glass. The ashes of the full-grown plant are very useful in the wash-house, for the purpose of economizing soap; they are mixed with enough water to allow of their being made up into balls, which are dried, and, when required for use, are put into fire until they acquire a red heat, when they are taken out and thrown into water, which, in an hour or so, becomes a strong ley. Moreover, the plant is so astringent that it has been employed for the purpose of tanning kid and chamois leather. Medicinally, this plant is said to have had, among the ancients, a reputation in chronic disorders, especially those arising from obstructions of the viscera and spleen, but it is not now much esteemed, though sometimes used, in the form of powder, to destroy worms, especially the tape worm; the caudex is the part used, in doses of from one to three drachms, repeated for several mornings, and followed by a brisk purgative.

No plant can require a less amount of cultivation when it is established; but there is a real or imaginary difficulty about transplanting it. Sir J. E. Smith says—"The roots [under-ground stems] are generally killed by transplantation. Mr. Taylor, a successful fern cultivator, informs me, however, that he removes it from the waste lands both for rock-work and potting, and finds it move well at any season of the year; being, moreover, a great pest in his cucumber beds when the under-ground stems are amongst the soil used, as it comes up over the bed, grows vigorously, and is with difficulty destroyed. I have potted portions of those stems which have lain exposed for some time, and have found them to grow freely. It will grow finely in any tem-

perature. Though it grows in exposed situations, it is very much finer in damp shady places. To form groups of this plant in parks, the following plan, recommended by Mr. Deewett, should be adopted:—Make choice of some spots of ground which have a partial shade of large trees in summer, say in half acres, and have them trenched, adding, if the land is strong, a good layer of peat or bog earth; have the ground in readiness for planting in March or April; take up the dormant stems in large square masses from the spots where they have been observed to grow, and plant them immediately at about a yard apart; enclose the patches with park hurdles, to prevent cattle from spoiling them before they get established. *Polystichum aculeatum* which is perfectly evergreen, is a very suitable companion.

GENUS XIV.

T R I C H O M A N E S .

TRICHOMANES., *Linnæus*.—Fronds pellucid; veins prominent branched, either ending at, or within the margin, or extended free into a filiform receptacle, around which the spore-cases are attached within an elongated cup-shaped involucrum of the same texture as the frond; receptacle more or less exserted.—Name derived from the Greek *trichos* (a hair), and *mania* (excess), in reference to the exserted hair-like receptacles.

1. *Trichomanes radicans*, Swartz (Bristle Fern); fronds 3-4-pinnatifid pendulous angular-ovate glabrous, segments linear entire, or obtusely bifid; involucres cylindrical scarcely 2 lipped solitary in the axils of the upper segments, more or less winged; receptacles filiform exserted.—Desc.: *Trichomanes radicans*, Swartz.

Hook. Species Filicum, i. 125. Bab. Manual, 2 ed. 415. *Trichomanes speciosum*, Willdenow. Newm. Brit. Ferns, 2 ed. 305. *Trichomanes brevisetum*, R. Br. Sm. Eng. Fl. iv. 311. Hook. Brit. Fl. 5 ed. 445. Franc. Anal. 3 ed. 62. *Trichomanes alatum*, Hook. Fl. Lond. *Trichomanes europaeum*, Smith. *Hymenophyllum alatum*, Smith. *Didymoglossum alatum*, Desvaux.—FIG.: Newm. 305. Eng. Bot. 1417. Franc. pl. 6, fig. 6.



TRICHOMANES RADICANS.

g. Andrewsii; fronds drooping lanceolate, lower pinnae distant short, involucres immersed, receptacles long curved upwards.—DESC.: Newm. Ferns, 2 ed. 318. Bab. Manual, 2 ed. 415. *Trichomanes Andrewsii*, Newm. p. 14.—FIG.: Newm. 315.

The Bristle Fern—one of the most rare and delicate of all our native species—has an elongated creeping caudex,



T. radicans, var. Andrewii (ex. Newman).

which, as well as the branching roots, are dark coloured, and clothed with small, thick-set, narrow, articulated scales, or bristles, thus acquiring a downy surface, which is less apparent in the variety *Andrewsii* than in the more usual state of the plant. The fronds, as has been well remarked, consist of hard, wiry, branched ribs, or veins, each furnished throughout with a semi-membranous, pellucid wing, the wings in fact forming the leafy portion of the frond; their shape is variable, from angular-ovate, approaching triangular, to oblong-acuminate, or lanceolate, the latter being the form of that of the variety *Andrewsii*. They spring up solitary, here and there from the caudex, as it becomes extended over the damp surface of the rocks, and are three years arriving at a mature condition; the young ones being formed about May, attaining their full development in the second autumn, and becoming fruitful in the autumn of the third year, after which they show symptoms of decay; the barren fronds, however, retain their freshness in moist situations for many years. The stipes is sometimes less than one-fourth the length of the leafy portion of the frond, and in others equally long; it is winged throughout with a narrow border. The fronds, which are circinate in vernation, are usually thrice pinnatifid; the primary divisions, which are ovate-lanceolate, and alternate, almost becoming pinnæ; the secondary lobes are broadly or narrowly ovate, according to their position, and the ultimate divisions are narrow linear, in some cases entire, and in others obtusely bifid. The whole of the leafy part of the frond is of a semi-transparent cellular texture, and is seen, when slightly magnified, to be elegantly reticulated. The veins may be compared to wiry ribs, branching and extending through all the divisions of the frond; in the barren parts these terminate at, or within, the apex of the ultimate lobe, but where the fructification is produced, they become elongated beyond the margin, the free portion being surrounded at the base where they are encircled by the spore-cases, by a monophyllous or elongate cup-shaped involucrum, and becoming more or less lengthened beyond the involucrum; the latter either projects beyond the margin, as in the ordinary plant, or is, as it were, immersed in the substance of the frond as in *Andrewsii*. The veins of the fronds have been already (p. 8) described as the receptacles; the veins, which in this plant are elongated beyond

the margin, bearing the fructification, are hence the receptacles; and it is around the base of these, in that part which is covered by the involucres, that the spore-cases are clustered; the degree of the elongation of the receptacles is very variable, sometimes they project but slightly, and at other times are two or three times as long as the involucres; in the variety *Andrewsii* they are five, and even six times as long as the involucres, and curve up from the surface of the fronds in a very conspicuous manner. The fructification becomes mature in the autumn.

Neither the species nor variety are certainly known to exist in a wild state in the United Kingdom, elsewhere than in Ireland, where both are found sparingly in several localities attached to dripping rocks, and the walls of damp caves, in shaded glens, and the vicinity of waterfalls. It is also found in some of the warmer parts of Europe, in Asia, and in both Americas.

This Fern requires a damp calm atmosphere, without which it will not thrive; hence, all attempts to cultivate it artificially, other than under close confinement, have failed. It likes warmth, and thrives admirably under a glass in a shady part of a plant stove, or greenhouse. Mr. Smith, who has grown it very successfully, thus explains how it; and the *Hymenophyllums* should be planted:—
"Procure some porous free-stone (if in one mass, so much the better) large enough to fit the mouth of the pot in which the plant is to be grown; this should be a good sized one, as the plants should be seldom disturbed. Fill the pot so far full of broken crocks for drainage, as to admit of the sandstone lying firmly in the mouth of the pot, and on a level with, or rather above the rim. Then strew a little silver sand over the stone, and arrange the caudex of the plant neatly on the surface; strew a little more sand over this, and follow by a good watering. If necessary, the plant must be supported in a firm position by means of some small stakes, judiciously placed. All this must be done with great care, for neither the plant nor the sand must be disturbed. Next place a hand or bell-glass tightly over the plant, and remove it to a shady place, either in the stove or greenhouse, or sitting room, but away from sunshine. After this, all that is required is careful and rather abundant watering, sufficient at least to maintain a constant dampness about the plant." Mr. Andrews, of Dublin, in

September 1841, formed a case purposely for cultivating this fern; he lined the bottom with zinc, and covered the frame-work with oiled lawn, and then planted the specimens in well drained pots in a compost of loam and coarse sand, interspersed with pieces of turf. He also suspended the stems across the roof of the case, attached to rods, covered with bass matting and moss. The plants were kept cool, and were well moistened daily. In October, 1843, the entire case was filled with fronds of large and strong growth. Mr. Ward cultivates this species with entire success, even amidst the smoke of London, in his close cases.

GENUS XV.

H Y M E N O P H Y L L U M.

HYMENOPHYLLUM, Smith.—Fronds pellucid; veins prominent, branched, either ending at or within the margin or extended beyond it into a narrow sub-clavate receptacle around which the spore cases are attached within a two-valved involucre of the same texture as the frond; receptacle included.—Name derived from the Greek *hymen* (a membrane) and *phyllon* (a leaf), admirably characteristic of the membranous texture of the fronds.

Analysis of the Species.

Involucres compressed serrate, }
pinnae vertical } 1. *H. tunbridgense.*

Involucres inflated entire, }
pinnae recurved } 2. *H. unilaterale.*

1. *Hymenophyllum tunbridgense*, Smith (Tunbridge Filmy Fern); fronds pinnate; pinnae distichous vertical; segments linear spinulose-serrate; involucres supra-axillary solitary sub-compressed spinulose-serrate; rachis

winged.—DESC.: *Hymenophyllum tunbridgense*, Smith, Eng. Fl. iv. 313. Hook. Brit. Fl. 5 ed. 446. Id. Species Filicum i. 95. Bab. Manual 2 ed. 416. Newm. Brit. Ferns, 2 ed. 321. Franc. Anal. 3 ed. 60. *Trichomanes tunbridgense*, Linnaeus.—FIG.: Eng. Bot. 162. Newm. 321. Franc. pl. 6, fig. 4.



a. HYMENOPHYLLUM UNILATERALE.

b. H. TUNBRIDGENSE.

The Tunbridge Filmy Fern is a slender and delicate species, having a black, very slender, creeping caudex, with fine wiry roots; this caudex is often matted and entangled, forming, along with the moss which accompanies it, a thick close turf over the rocks and stones; and as well as the roots is furnished with a few scattered hair-like scales. The fronds are small, tender, and of membranous texture, erect, from one to four inches high, somewhat lanceolate in circumscriptio

n and pinnate in composition,

the pinnae being alternate, once or twice pinnatifid, and connected by a wing extending along the rachis, the pinnae, wings, and involucres all lying in the same plane; the pinnae, moreover, though sometimes alternately branched, manifest a decided tendency to ramify on the upper rather than the lower side; the ultimate segments are linear obtuse, with a prominent central vein, and a spinosely serrate margin. Or the fronds may be considered as a series of stiff branched veins, furnished with a membranous wing throughout, except in the lower part—the stipes, which varies from one third to one half of, or equal to, the length of the fronds. The fructification is borne (usually) by the first vein on the upper side of the pinnae, thus becoming supra-axillary. Deviations from this may be sometimes observed, in which, from the involucres and their contents having taken the place of other lobes of the leafy part of the frond, the identity of origin between them becomes manifest; in fact, in ordinary cases, the fructification takes the place, on the fertile pinnae, of the first superior lobe of the barren pinnae. The spore cases are collected into a roundish mass upon the receptacle, which is formed of a vein lengthened out beyond the margin, and assuming a cylindrical or sub-clavate form; and they are surrounded by an involucre of two nearly orbicular valves, which are adpressed throughout the greater part of their length, but become slightly gibbous at the base, where the spore cases are situate, and are spinosely serrate on the upper margin. The receptacle does not extend beyond the middle of the valves. The fructification is mature in July. The plant is of an olive green colour, and remains fresh at all seasons; its texture is membranous, showing itself elegantly reticulated when slightly magnified.

This little species is found widely distributed in England, Wales, Scotland, and Ireland, growing amongst moss in mountainous situations, or on the surface of damp rocks and stones. It is also found in the alpine districts of Europe, in the Azores, and in Madeira, at the Cape of Good Hope, in South America, Tasmania, and New Zealand.

2. *Hymenophyllum unilaterale*, Willdenow (Wilson's, or the Scottish Filmy Fern); fronds pinnate: pinnae recurved digitato-pinnatifid, sub-secund; segments linear

spinlose-serrate; involucres supra-axillary solitary, inflated entire; rachis slightly margined.—Desc.: *Hymenophyllum unilaterale*, Willdenow Sp. Pl. v. 521 (1810). Newm. Brit. Ferns, p. 14. *Hymenophyllum Wilsoni*, Hooker, Brit. Fl. (1830). Newm. Brit. Ferns, 2 ed. 325. Bah. Manual, 2 ed. 416. Franc. Anal., 3 ed. 61.—Fig.: Eng. Bot. Supp., 2686. Newm., 325. Franc., pl. 6, fig. 5.

Wilson's Filmy Fern a good deal resembles the Tunbridge species in general characters; the texture of the frond in both is delicately membranous and pediceloid, and when magnified even but slightly, it is seen to be composed of closely arranged cells, which give it a beautiful reticulated appearance. The caudex is filiform, wiry, and creeping, with small fibrous roots; and is sparingly furnished with small brown, pointed scales. The fronds are linear lanceolate in circumscription, rigid, and pinnate, from one to four inches high, or sometimes larger. The stipe is of variable length, as in the allied species; it is terete, the rachis being also terete in the lower part, and slightly winged above. The pinnae are convex above, or are recurved so as to appear sub-unilateral, the involucres being usually curved in an opposite direction; they are wedge-shaped in outline, digitato-pinnatifid, the segments being linear obtuse, and spinosely serrate along the margins. The fructification is in this species also supra-axillary; but the receptacle is surrounded by an involution of two oblong convex or inflated valves, touching only by their edges, which are quite entire. The fructification is mature in July. In its texture and colour the plant is very similar to the *Hym. tunbridgense*; in both, the young fronds are produced towards the end of summer, and retain their green colour until the next year, after which they become brown, and finally almost black.

This species is equally with its congener widely distributed throughout the United Kingdom, growing like it on the mountains and on damp rocks; the present is, however, the more abundant of the two in the Highlands of Scotland and in Ireland. It is found in other parts of Europe, in Africa, New Holland, and South America.

The *Hymenophyllums* may be cultivated in the same manner as the *Trichomanes*. The surface of the material

on which the plants are placed should be covered with sphagnum, which is the best description of moss for this and similar purposes.

GENUS XVI.

OSMUNDA.

OSMUNDA, *Linnæus*.—Spore-cases imperfectly two-valved, opening vertically, stalked, clustered, and forming a terminal branched spike.—Name of uncertain derivation; perhaps commemorative.

1. *Osmunda regalis*, Linnæus (Osmund-Royal or Flowering Fern); fronds bipinnate, pinnae oblong nearly entire, dilated and somewhat aricled at the base; spore-cases arranged in a clustered terminal panicle.—Desc.: *Osmunda regalis*, Linnæus. Sm. Eng. Fl. iv. 314. Hook. Brit. Fl. 5 ed. 447. Newm. Brit. Ferns, 2 ed. 332. Bab. Manual, 2 ed. 416. Franc. Anal., 3 ed. 63.—Fig.: Eng. Bot. 209. Newm. 331 and 333. Franc. pl. 7, fig. 1.

The Osmund Royal is the most stately of the British Ferns. It has a tufted caudex, which attains a large size, and in damp shady situations, a height of two feet, and upwards, then acquiring a resemblance to the trunks of the tree ferns; this is hard and scaly outside, beset with numerous strong fibres, and within has a whitish core. The fronds are circinate in vernation, and when young are very tender, and usually of a reddish or purplish colour; they shoot up with great rapidity, and attain sometimes the height of ten or twelve feet in damp sheltered spots, and from two to four feet in more exposed and drier situations; they are developed in May, and destroyed by the early frosts. The stipes is stout, smooth, without scales, and of variable length, and as well as the rachis, is succulent



OSMUNDA REGALIS.

while young, but becoming woody. Some of the fronds are fertile, some barren, the latter differing from the former only in the absence of the panicle of spore-cases.

the leafy parts being continued to the apex; all are bipinnate, with the pinnae arranged in pairs, nearly opposite; they are either erect, or less frequently, and chiefly when growing by water, pendulous. The pinnae are lanceolate or ovate-lanceolate, with opposite or alternate pinnules, of an oblong or linear form, blunt at the apex, and somewhat dilated and auricled at the base, especially on the lower side, the apical pinnule being usually somewhat more acute. The venation is very distinct; each pinnule has a prominent midvein, the lateral veins from which are forked almost at their base, the branches being usually again divided, running in parallel lines, and terminating in the margin. The fructification consists of the upper pinnae changed from their leafy to a soriferous state, forming a more or less compact cluster of spikes, covered over with spore-cases, which are attached to the lateral veins of the altered pinnules, of which only a slight wing is developed on each side of the midvein. It is not unfrequent to find the pinnules on some of the pinnae partially altered, a few masses of sori occurring at the base, while the apex remains leafy; sometimes the pinnae near the apex become soriferous, while the extreme apex itself remains leafy and barren; these are sufficient indications of the nature and origin of the fructification. The spore-cases are sub-globose, each supported by a short stalk, reticulated, and somewhat two-valved, opening vertically, the two valves being supposed to originate in the upper and lower epidermis of the frond. The fructification reaches maturity about August.

Pretty generally distributed throughout the United Kingdom, though local in its distribution; it is not seen much above the sea level, and thrives best in marshy places. In Ireland it is most abundant. It is common throughout Europe and North America.

The caudex possesses tonic and styptic properties, but is not much used.

This species is of easy cultivation, preferring moist situations, and a peaty soil. It is very suitable to plant about rockwork, where its habits can be accommodated; and though growing most luxuriantly in a sheltered position, does not refuse to grow when moderately exposed. It is propagated by detaching and planting any lateral off-shoots from the caudex.

GENUS VIII.

BOTRYCHIUM.

BOTRYCHIUM, Swartz.—Spore cases two-valved opening transversely, distinct sessile and clustered in a pinnate spike, forming a separate branch of the compound fronds.—Name derived from the Greek, *botrys* (a bunch of grapes), the spore cases being produced in branched clusters.

- I. *Botrychium Lunaria*, Swartz. (Moonwort); fronds solitary; barren branch pinnate; pinnae lunate or fan-shaped, jagged or crenate.—Desc : *Botrychium Lunaria*, Swartz. Syst. Eng. Fl. iv. 315. Hook. Brit. Pl. 5 ed. 447. Newm. Brit. Ferns, 2^d ed. 387. Bab. Manual, 2^d ed. 416. Franc. Anal, 3^d ed. 65. *Ornunda Lunaria*, Linneaus. *Esmaria minor*, Ray. *Lunaria Botrytis*, Bauhin.—Fig : Eng. Bbt. 318. Newm. 337. Franc. pl. 7. fig. 2.
S. *pinnatifida*; pinnae pinnatifid.—Desc : *Botrychium rutaceum*, Swartz.
γ. *linearis*; pinnae linear-acute toothed; fertile branches many.—Fig. Newm. 348.

The Moonwort is almost without a caudex, this part being reduced to a mere point at the base of the stipes; and is furnished with stout succulent brittle roots, issuing in irregular whorls from a thicker perpendicular one. The fronds are annual growing up towards the end of April, and perishing in the course of the summer or the autumn. When at rest, the caudex bears a bud or hybernaculum, in which the incipient fronds are encased by brown membranous sheaths, probably the persistent bases of the fronds of former years; enclosed in these sheaths the entire fronds are to be found in an embryo condition, but perfectly formed, with the two branches of the frond placed face to face, the



BOTRYCHIUM LUNARIA.

fertile being clasped by the barren branch. Within the base of the growing frond of one year, are thus enclosed the rudimentary buds of the two following years. The stipe is erect, smooth, cylindrical, and hollow, with two or three bundles of woody fibre embedded in its succulent substance, its base invested by the sheaths already alluded to. Above, it becomes divided into two branches or pinnae, of which one is leafy and barren, the other fertile; both are pinnately divided. The entire frond is from three to ten inches high. The pinnules of the leafy branch are smooth, and of a glaucous green, lunate or fiabelliform, the margin being crenate, or more or less deeply lobed on the margin; sometimes they become partially sterile. The fertile por-

ion is divided into branches corresponding to the pinnules, these are again more or less branched, and on the secondary branches, distinct but clustered, the brown globose stalkless spore cases are borne; these are formed of two concave valves, and when mature open transversely; occasionally two or more fertile branches are produced. The fronds are straight in vernation. The veins are free, all proceeding from the base of the pinnules, radiating towards the margin, and becoming irregularly forked in their progress. The fructification is mature early in June.

A rather local plant though widely distributed in the United Kingdom, occurring in dry open heaths, and elevated pastures. It is also found throughout Europe and North America.

This is a difficult plant to get established under cultivation, often refusing to vegetate. This probably arises from its being placed along with other ferns, and kept damp, and for the most part closely confined. It rather prefers to be kept moderately dry, cool at the root, and where there is a circulation of pure air. It prefers rich vegetable soil; uncultivated peat earth is very suitable for it, but it requires to be well drained. The roots should be transplanted in the spring when dormant.

GENUS XVIII.

O P H I O G L O S S U M .

OPHIOGLOSSUM, Linneus (Adder's tongue).—Spore cases two-valved opening transversely coarctate in a simple two-ranked spike, forming a separate branch of the fronds.—Name derived from the Greek *ophios* (a serpent), and *glossa* (a tongue), the fertile frond bearing some resemblance to the tongue of a serpent.

1. *Ophioglossum vulgatum*, Linneus (common Adder's

tongue); fronds solitary; barren branch ovate-obtuse.—
DESC: *Ophioglossum vulgatum*, Linneus. Sm. Eng. Pl. iv. 316. Hook. Brit. Pl. 5 ed. 447. Newm. Brit. Ferns, 2 ed. 349. Bab. Manual, 2 ed. 416. Franc. Anal. 3 ed. 66.—FIGS: Eng. Bot. 108. Newm. 349. Franc. pl. 7, fig. 3.



OPHIOGLOSSUM VULGATUM.

The common Adder's tongue has the same habit as the Moonwort, but a different structure. Like it, too, it is straight in its vernation, in which respect these two plants differ from all the other native ferns. In this species, however, the rudimentary plant is exterior to the stipes, instead of being enclosed within its base. The fronds are erect, varying from three or four inches to a foot in length, smooth, and of annual duration, growing in April and May, and perishing in the course of the summer. The stipes is

wreath, smooth, of variable length; root, shallow and resent, with bundles of woody fibers. Above, it becomes divided into an entire, ovate, plantling, leaflike, sessile frond, and an erect linear stalked spike of fructification, in which the spore cases are embedded, and crowded along the two straight flat margins; the spore cases are thus regarded as being formed on the margins of a contracted frond. The frond is of a deep green, traversed by irregular anastomosing slender veins. The fertile spike springs from the inner base of the leaf, and is distinctly stalked, the stalk varying much in length, being sometimes not more than an inch, and at other times several inches long; the spike is linear, very slightly tapering upwards, and consists of two lines or series of crowded embedded spore cases, opening transversely, the gaping concave cases, when empty, appearing like a series of spherical cavities along the margins. The fructification is mature in June. In some rare cases, more than one fertile spike is developed on each plant.

A local species, but generally exceedingly abundant where present, which is in moist pastures and meadow lands, where it is sometimes so abundant as almost to usurp the place of the grasses. It is pretty generally distributed over England—less generally in Wales, Scotland, and Ireland—and is also common in Europe, and said to be found in Africa and North America.

Lightfoot says—"The common people sometimes make an ointment of the fresh leaves, and use it as a vulnerary to green wounds, which is a very ancient application." He also states that the *Botrychium* possesses similar vulnerary qualities.

This plant is not difficult of cultivation in a moist loamy soil, and a cool situation, and may be grown either in pots or planted out. It is nothing more than a curiosity, and owing to its prevalence, would hardly be considered even that in the many localities where it grows naturally.



SPORE CASES.

1. Polypodiæ; 2. Hymenophyllicæ: a. Trichomanæ; b. Myce-nophyllum. 3. Osmundacæ; 4. Ophioglossacæ: a. Holo-trichium; b. Ophioglossum.

The accompanying Illustration will convey an idea of the external appearance of the spore cases. Those of the whole tribe of Polypodiæ have a close resemblance; the others, as will be seen, are more diverse (see pp. 8—9.)

The contents of these cases are the germinating atoms or spores; and, by means of these, the species may be propagated under the following course of treatment:—Half-fill some shallow wide-mouthed pots with broken crocks, and on this put a layer of about two inches of little lumps of spongy turf peat soil, mixed with soft sandstone broken in small lumps of the sizes of nuts and peas; this compost should not be consolidated. Next, shake or brush very gently over a sheet of white paper, a frond of the species to be propagated; the fine brown dust thus liberated consists of the spores, in greater or less quantity, intermixed with more or less of the spore cases, some of which usually become detached in the process. This dust is then to be regularly and thinly scattered over the rough surface of the soil, which is immediately to be covered with a bell-glass, large enough to fit down close within the pot. The pots are at once to be set in feeders, and these are to be kept filled up with water; they may either be placed under a hand-glass in a cold frame, or in a greenhouse, as may be most con-

venient. Some time, varying according to the freshness or otherwise of the spores, will probably elapse before germination commences. The first indications of germination will consist in the appearance of little patches of a green crust, resembling a liverwort; subsequently, small imperfect fronds will appear, and these will become more and more perfect in succession. During this time, the supply of water must be kept up, and the glasses kept over the young plants. When two or three fronds are developed, the glasses should be tilted on one side for a short time every day, and ultimately entirely removed, the pots still being retained under a hand-glass; after a week or two they may be taken up, carefully separated, and potted singly in small pots. The young plants should still be kept under a hand-glass until established, and then removed to a close cold frame, gradually inured to the degree of exposure respectively proper for each, and ultimately submitted to the same treatment as the mature plants.

THE END,





